DOCUMENT RESUME

ED 070 562 24 RC 006 653

TITLE	Development of a Problem Solving Capability for Rural School Districts. Final Report.
INSTITUTION	Seattle Public Schools, Wash.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C. Regional Research Program.
BUREAU NO	BR-2-J-015
PUB DATE	Nov 72
CONTRACT	OEC-X-72-0005(057)
NOTE	51p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Administrative Organization; Educational Facilities; Educational Technology; Enrollment Projections; *Information Dissemination; Information Storage; *Management Information Systems; *Problem Solving; *Rural Areas; *School Districts; Staff Utilization
IDENTIFIERS	Washington State

ABSTRACT

A model was developed to be used in the resolution of problems in the rural and suburban school districts in Intermediate School District #110 service area of King County, Washington. The system based on this model was used to move information from the professional/technical base to the manager confronted with the problem resolution. The problem resolutions involved staffing, enrollment, space, migration, and dropouts. It was decided that the restraints and requirements necessary to operate in a problem-solving capacity in the rural school district have been identified and that educational management has been receptive to the new ideas associated with this problem-oriented concept. It was noted that, in the future, the main effort will be directed toward the design of the management information system to insure its excellence in meeting the needs of local administrators. Appended are 25 charts and diagrams, and a 25-item bibliography is included. (PS)

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FINAL REPORT

PROJECT NO. 2 – J – 015

CONTRACT NO. OEC – X – 72 – 0005 (057)

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PROJECT DIRECTOR

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100 CROCKETT STREET

SEATTLE, WASHINGTON 98109

DEVELOPMENT OF A PROBLEM SOLVING CAPABILITY FOR RURAL SCHOOL DISTRICTS

NOVEMBER, 1972

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

OFFICE OF EDUCATION

REGIONAL RESEARCH PROGRAM

RC 006653

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FINAL REPORT

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Contract No. OEC-X-72-0005(57)

DEVELOPMENT OF A PROBLEM SOLVING CAPABILITY FOR RURAL SCHOOL DISTRICTS

Project Director
JACK H. TROWBRIDGE

INTERMEDIATE SCHOOL DISTRICT No. 110
Seattle, Washington 98109

November, 1972

ACKNOWLEDGMENT

A special note of appreciation is extended to Mr. Robert J. Marum, Superintendent, Intermediate School District No. 110, and Dr. John E. Bean, Director, Educational Research, U. S. Office of Education, Region X, Seattle, Washington, without whose support this program would not have been possible.

Special thanks are extended also to all of the superintendents and administrators in our service area who contributed so much to the success of this program.

Jack H. Trowbridge

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DEVELOPMENT OF A PROBLEM SOLVING CAPABILITY

FOR RURAL SCHOOL DISTRICTS

ABSTRACT

We accomplished our objective in this project to develop a model useful in the resolution of problems in the school districts in Intermediate School District No. 110 service area of King County in the State of Washington. We designed and implemented a system based upon this model to move the information from its point of origin, the professional/technical base, to the manager confronted with the problem resolution. We accumulated a base of regional educational data to respond to the flow requirements of the system.

We have developed a management information system for the local administrators. The problem resolutions have involved staffing, enrollment, space, migration, and dropouts. Purposely, we did not make isolated probes into specific areas, but rather we made simultaneous thrusts into several related areas, thus presenting to the administrator the relationships of the groups of information in this system. Educational management has been receptive to the new ideas associated with this problem oriented concept, and we are very optimistic about the future success of the program.

In the future, our main effort will be directed toward the design of our management information system to insure its excellence in meeting the needs of the local administrators. We will also continue to work toward the accumulation of a base of educational technology useful in local school district operations.

This grant has made it possible to implement a management information system and problem solving capability for school districts in our area. During the term of this project we believe we have identified the restraints and requirements necessary to operate a problem solving capability in the rural school district. Although there are programs in progress designed to attack certain restraints for particular problems, we have found no other overall systems approach to problem solving in education.

We invited the twenty-one (21) school districts in our service area (King County, State of Washington) to participate in this study. This is a review of our progress in this program.

We began the investigation with the premise that disciplined information collection and review is required if problem resolution is to be effective. Further, problem resolution was not treated as a static condition; the resolved becomes unresolved; new information must be gathered and analyzed, alternatives reviewed again, and new resolutions accepted. This is the cycle. We were faced with building an information system for management if we were to resolve their problems effectively.

As Steiner put it (Steiner, 1969), "The cornerstone requirement for excellent information systems is understanding each manager's needs for knowledge." For a new program such as this, to operate effectively, we needed to define the interests and relationships between the educational managers and the information elements.

PROBLEM

We started by assembling a base of regional information to draw upon. Uppermost in our minds; in assembling this information, was Ralph Cordiner's remarks (Steiner, 1969, p. 486)

> "It is an immense problem to organize and communicate the information required to operate a large, decentralized organization . . . This deep communication problem is not solved by providing more volume of data for all concerned, by faster accumulation and transmittal of conventional data, by wider distribution of previously existing data, or by holding more conferences. Indeed, the belief that such measures will meet the . . . (management information) challange is probably one of the great fallacies in business and managerial thinking. What is required, instead, is a far more penetrating and orderly study of the business in its entirety to discover what specific information is needed at each particular position in view of the decisions to be made there."

The manager must assemble from this base that information he feels will enable the particular participants to arrive at an acceptable resolution. In school district administration, as in all organization, there exists a gap which disrupts the orderely transmission of information. At one end of the flow there is the technician, i.e., the accountant, the curriculum expert, etc., with their professional expertise. On the other side is the administrator, the generalist, who must resolve his problems in terms he and his audience will understand. To fill this gap between the administrator and the professional/technical output, a synthesis capability must exist. In this middle management zone the necessary modification to the information must take place to make it of value to the administrator. This synthesis, to be successful, must impart to the technical information a transparency (Swanson, 1971) to indow it with a recognizable and significant output to the participants if they are to resolve problems. Special care must be taken to insure that the conversion process does not reduce the professional accuracy of the information, or obscure its meaning to the recipients.

CONTROL

We felt there were several critical controls that must be met if the information gap is to be bridged and mere information flow is to grow into a management information system (MIS). The guiding principle was the way in which an information system is employed must evolve to support the policies of educational management. It does so by adapting to the decision environment to which it feeds information. To change the decision making climate is not one of our goals. We expect to modify and change the system as the climate requires. Some other controls are:

(1) Information must be acceptable to the user in order to be used. To the user this means the information must be timely and accurate to his specifications.

(2) Information is unbiased only to the first person who receives it and not necessairly to the ultimate decision maker.

(3) Any information system which is to remain in existence must provide the user with something that he finds valuable in the achievement of his individual goals.

(4) A management information system must support the actual (not stated) policies of the organization. Organizational problems cannot be solved with information systems. Only information problems can be solved with information systems.

   (a) Any information that is provided by MIS will be used only if it supports the goals of the organization.

   (b) The amount of utilization of MIS is in direct proportion to the number of decision points in an organization. If there is a highly centralized organization, or if managers are not resolving problems, there is little need for an MIS.

   (c) Management, the participants, or the audience must not have a punitive attitude towards those who supply the information.

(5) The amount of information utilized by an organization is in direct proportion to its risk tolerance.

(6) Information is neither good or bad, valid or invalid. Any such interpertation depends on the user and its acceptability.

(7) Information is transmitted in direct proportion to its ability to be received.

Presently, the above principles must be accepted intuitively. We believe we may prove the validity of some of them by trial and error, but detailed investigation is beyond the scope of this study. We have found that they present realistic restraints to the systems builder, and provide an environment to assemble and use the necessary information.

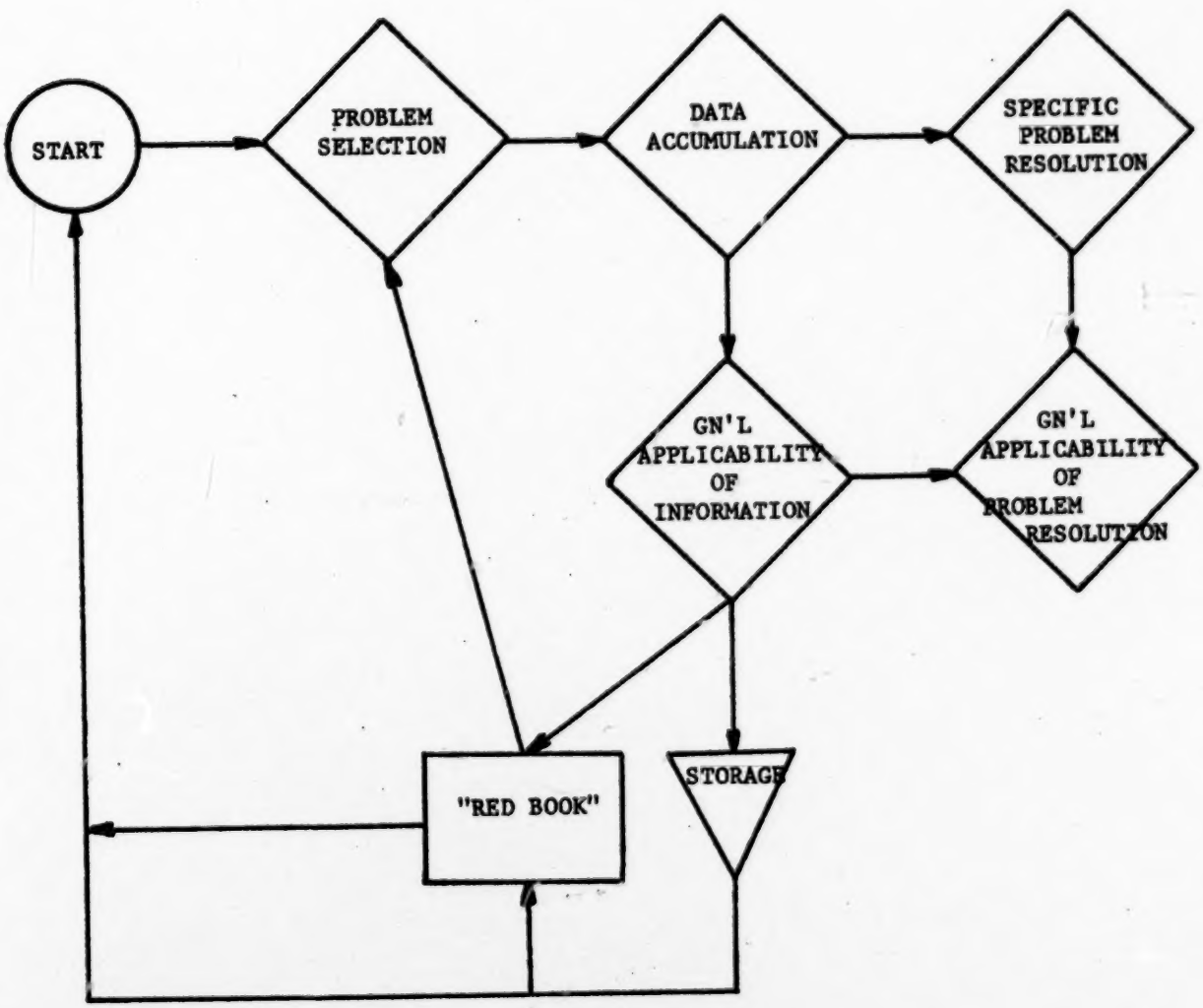
These principles have described human and organizational traits which a MIS must work within. We have not described such tools as retrieval, storage, data processing, models, operational research, finance, curriculum, purchasing, instruction . . . or dollars. Forrester said of dollar decision making:

> "The money network does not provide adequate inputs for creating actual managerial and economic decisions. The money network constitutes a summary of past transactions and acts as a restraint on future decisions but is not sufficient guide to the making of these decisions."

Several years ago Program Planning Budget and Evaluation System (PPBES), was presented not as a tool of MIS but as MIS. The Iowa Project, just completed, is described as a tool called MIS. The Iowa project's emphasis is dollar restraints, and dollar restraints like PPBES are only tools of MIS. As Steiner said, current "systems are fundementally accounting systems." ERIC is certainly valuable to research in education, but its system is research and storage, and not applicability to daily operations of a dynamic school district. Current efforts appear then to be directed to the building of a base of unrelated information, or extended Financial Systems rather than defining information relationships requirements and systems applicability.

METHODS AND PROCEDURES

Our method is simple. We define a problem with the manager; for example, are our staffing ratios actually impeding the progress of education in our district? The manager certainly would want to review his staffing ratios. He may want to go on a review of salaries, space, philosophy, etc. As we assemble the information for the first district we look for applications elsewhere of the assembled information. In a real sense we have used the manager's problem as a catalyst to implement our MIS. The following model illustrates our case.



Our first venture into problem resolution turned up the following questions: (1) What is the adequacy of the district's educational facilities; (2) What will our future enrollment be in the district; (3) What must our staffing be in relation to our enrollment? We prepared initial information formats, i.e., graphic and tabular displays for these thrusts. We are in the process of revising these formats for the third time in an effort to make them compatible with our requirements. Our approach to these questions was broad enough, with the flexibility to accomodate various technical inputs. For example, as we assessed enrollment projections (See appendix A) we continued our thrust through to future levy requirements. We developed current space utilization for various teaching disciplines (Appendix B) in junior and senior high schools to use as an avenue of approach to instructional and curriculum experts to obtain the impact of educational philosophy on space.

There is a relationship between personnel staffing and facility requirements. Fortunately a group of districts in King and Snohomish Counties in the State of Washington have developed guidelines, definitions, and storage capability for comparative school district staffing ratios. We used their format, with only slight modification, to collect data from participating districts (Appendix C).

We also developed a single information format for the following elements, comparing different districts for the 1970-71 period:

Total Assessed Valuation
Number of Mills Passed For the Year
Student Enrollment
Assessed Valuation Per Student
Levy Income Per Student
Total Cost Per Student

We labeled this a Performance and Review (PAR) chart. (Appendix D).

Our objective first, was to present the policy of judging the quality of a district by more than one factor. Secondly, and more important, we believe this type of format will prove useful to the administrator for a simultaneous review of amplitude, and phasing of several indicators or measurement of trends. The disadvantage of this "extract" type of chart is that it does not lend itself to the dynamics of time. The alternative of the development of supplementary time sequence charts (Appendix E) appear only as a first solution, as they are bulky and do not lend themselves to comparative analysis.

To make displays readily accessable to districts in separated geographical locations we implemented our "Red Book" of information. As we develop information, it is sent to each participating district for inclusion in their "Red Book." As they define problems they may review the"Red Book" for a general thrust and then communicate to the ISD staff those areas they feel would be most appropriate for the problem resolution. This facilitates identification and direction to both parties at an early time in the resolution activities.

RESULTS

Because of the sensitiveness of information, our first effort at problem solving was directed to the superintendent. Obviously the superintendent has delegated problems to his administrators, and our dilemma was, which administrators have the judgement to use the information in the correct manner? It appears now that until there are indications that information is being misused by specific individuals, we would supply all necessary information at any level of requirement. In almost all cases to date administrators have used very good judgement in their use and dissemination of information.

We found that presenting a format (graphic display) of information with no supporting ground rules and paramenters leads to confusion. The paramenters

should be printed right on the face of the chart. With no clear definition of the paramenters, the most noticeable result is that the administrator is using inferior or erroneous criteria to judge the information's value. When the parameters are presented at the same time the administrator will:

(1) Conceptualize the effect of the addition or deletion of parameters to present the information reflecting his current position.

(2) Visualize the various alternatives open to him as his audience will vary.

(3) Resolve acceptable limits of fluction of the information by the manipulation of ground rules.

Tabular displays do not lend themselves to the quick portrayal of an immense amount of data. They do not facilitate systems development where it is important to visualize and conceptualize the important relationships between a limited amount of data. We found that a combination graphic/tabular most successful in presenting information. We feel that an MIS is not primarily concerned with the movement of gross amounts of data, it is concerned with relationships.

In our current phase of development of this MIS we felt it necessary to present comparable statistics to the superintendents. That is, how one district shows up against another. To some districts this presents a problem to the administrator of good and bad. We have presented comparable statistics in this manner only as a starting point. With only a single information thrust, as we had in many cases, it was difficult to present it as supplementary information. We have a few cases where we presented several bits of information that was mutually supportable, but until we develop more information definitions, we are in a period when it is difficult to satisfy our preferences.

Our initial outputs of information formats were generally clear, and reliable; we felt the statistics were accurate. With our limited resources it was not possible to produce a professionalism we might have desired. This is true also

in our re-run of the statistical formats. Even though the statistics themselves are not improved by professional printing standards, the presentation is more acceptable. and we intend to devote more resources to improving our printing standards.

As we mentioned earlier we invited twenty-one (21) districts in King County to join with us in the project. The makeup of the districts was as follows: one (1) district was urban, fifteen (15) were suburban, and seven (7) were rural. The fifteen (15) districts that have decided to participate financially in this program for the next year are divided as follcws: nine (9) suburban districts; and six (6) rural districts. The one (1) urban district is co-operating with us, and we are optimistic that they will contribute financially to the support of our operation next year. One of the larger suburban districts is in this position also. Of the remaining five (5) districts, we have minimal expections of their joining this group. This is due to three reasons. First, some administrators expect to take their direction and follow the lead of the largest urban district, and they feel ary action by them would not be useful. Secondly, one district has such a small administrative staff that they feel they cannot take on any additional duties as required to implement this study. And thirdly, some of the larger districts are not joining because:

(1) They feel their planning staffs are adequate to complete their work.

(2) They are innovative in their education, and they demand that any information released conform to their criteria.

(3) They have reservations about using comparative data of separate school districts.

The basic difference between the participating and non-participating groups is that the former believe more may be gained by gathering information on an inter-district level; sharing priorities concerning the information, and comparing the results of operations in the hopes of taking the best from each

district's efforts. They believe that ultimately information dissemination on a large scale to the lay public will be the rule. The implications of this to the educator are enormous. His audiences' alternatives are as diversified as their backgrounds. If he is to cope with this, and be a leader, he must be provided with the capability of a reactive system. They must prepare information definitions and relationships which will accurately describe and measure the direction and magnitude of school operations.

The group that did not join in our operations question the validity of every district implementing the newest educational innovations. As Mort put it, (Ross, 1958) there are "lighthouse" districts in every region and the administrators in these districts are bound to provide this leadership to the less affluent school districts. To provide this leadership then these "lighthouse" districts must have their own information channels for the proper direction of the new programs.

We have two concerns about a "lighthouse" concept. First, administrators from all districts should be able to review the unfiltered progress of each innovation. I believe with inter-district insight, innovative programs could be subject to a more stimulating review, implementation, and operation.

The second reason has to do with organizational excellence. It is apparent that as each level of government constructs its information system to implement management's problem resolution and decision making, in years to come we would have three (3) levels of information. One for local districts, one for state offices, and one at the federal level, all competing for information. Because most of the information would come from the local school district, it is easy to see that the data gathering requirements imposed on the local districts would be so great they would have little time for anyhting but supplying statistics to state and federal agencies.

The major requirement for information use and systems is at the local level to enable the local districts to make intelligent educational decisions, and to provide direction to state and federal authorities as to the type and form of information that will meet this criteria. If these "lighthouse" districts fail to cooperate with neighboring districts in this local system, then not only will there be confusion from multiple local inputs to the higher agencies, local administrators will have an inferior system. To be successful, first of all, the system must satisfy internal requirements of the organization along with the requirements of lateral organizations, i.e., other school districts. This system must also adjust to the verticle requirements of county, state, and federal agencies. If local districts are to maintain their autonomy they must participate in this effort. Governmental agencies must be made to realize it is essential they tailor their requests to fit the local systems.

CONCLUSIONS

The problem oriented approach to the design, implementation, and operation of an MIS is valid.

After the first confrontation, educational management is receptive to this MIS.

The needs of MIS must be clearly differentiated from the needs of storage systems.

The combination graphic - tabular approach to information portrayal to the manager is effective in transmitting large amounts of information in very short periods of time. It is definitely superior in this respect to the printer - read-out of the data processing printer.

The "Red Book" of information appears to provide a method of storage of relavent information available to the administrator in his day-to-day problem resolution

activities. More work needs to be done here to keep the size of the "Red Book" within bounds, make it readily accessable, and really become a part of the manager's internal planning.

Failure to meet the manager's information needs is the first requisite of a successful MIS system. Further we think three of the most common reasons for failure to meet these needs are:

1. Failure to reflect organization realignments
2. Failure to reflect new organizations
3. Failure to reflect new information

We believe that advances in MIS and related planning would be accelerated significantly if certain other courses of investigation were conducted in a timely fashion.

One organization (Pontiac, 1972) found that before they could progress very far in implementing a system, it was necessary to send their management to school to learn what MIS was all about. Each manager in this organization is attending or has attended classes for 60 hours of instruction in MIS. This company has a sophisticated organization, but they feel this step is necessary before they implement a system. An effort of this type will significantly accelerate MIS in education.

If educational managers are to have, truly, a base of information, some structuring in education technology is necessary. A gathering process must be implemented to: separate what we know about education, and what we do not know, what is generally accepted and what is not accepted information. The fractional thrusts that are occurring now must be gathered together in a meaningful way for reference. This might take the form of a "Handbook For Education." This is not unrealistic, Kozmetsky talked about the need to build a technology for education. We have handbooks on engineering, chemistry, physics, and business, why not education?

An investigation would be productive in the best way to utilize detailed models in educational systems. In our project we decided our system catalyst would be the problem, i.e., because of the need for a problem resolution, managers would use the system because it fulfilled their needs. There are those who feel that models act as catalysts. We tend to think that on the operating levels, detailed, technical models are a deterrent to the free flow of information. There is an area between the system designer and the user where the model's marginal utility ceases to be of importance. This should be investigated.

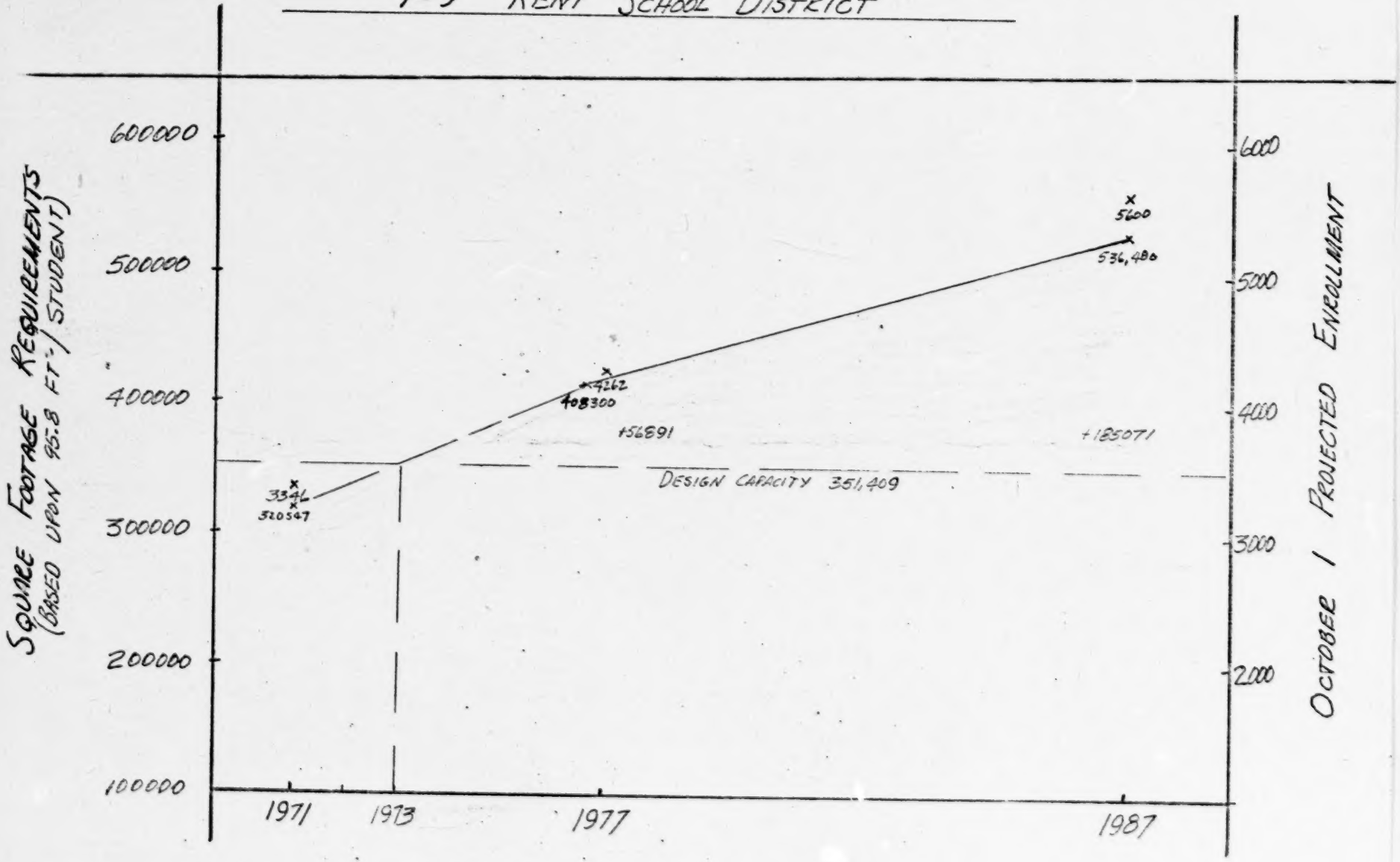
And finally, because we are all looking for that seemingly impossible, "total" system, an invistigation should be conducted into what "families" of information are most useful to the administrator. We believe that a total system operation, will result, not from a consolidation of many "thrusts," but will result from a consolidation of families of information thrusts. We believe as their family relationships are defined the roll of the various tools, i.e., finance, storage, retrieval, etc., will become better known.

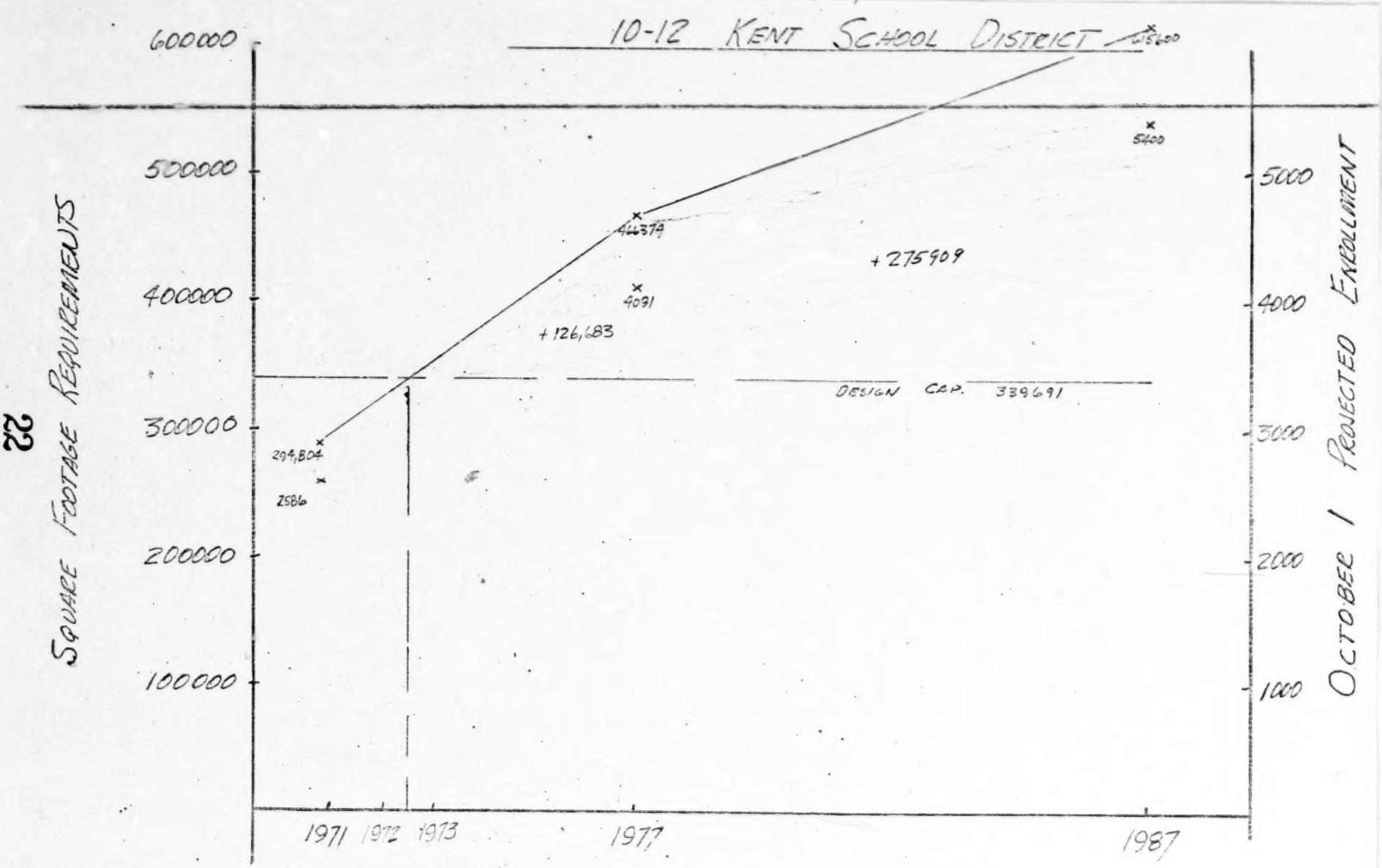
(14)

APPENDIX

APPENDIX A

7-9 KENT SCHOOL DISTRICT




10-12 KENT SCHOOL DISTRICT
SQUARE FOOTAGE REQUIREMENTS
OCTOBER 1 PROJECTED ENROLLMENT
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500000
400000
300000
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100000
5000
4000
3000
2000
1000
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+275909
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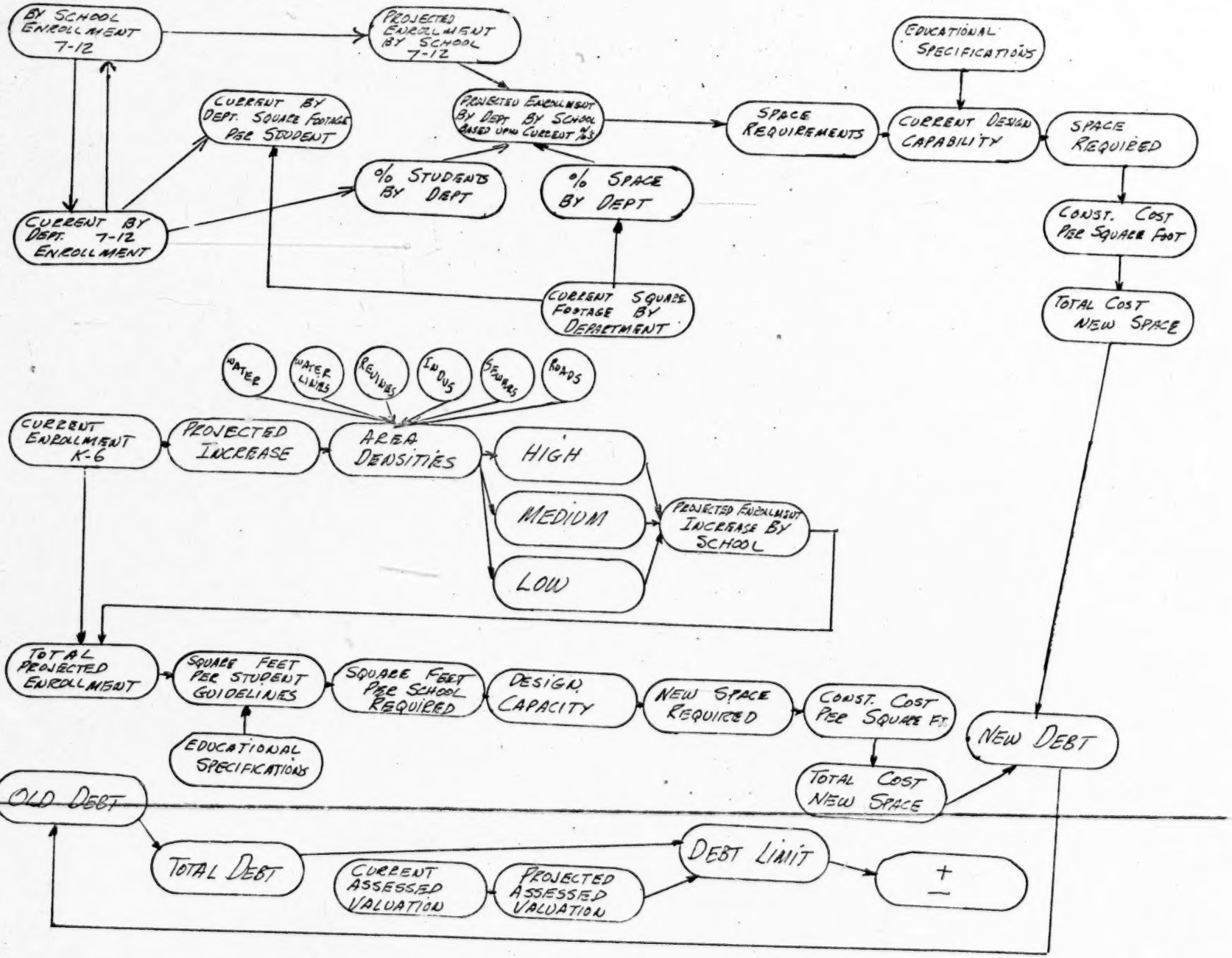
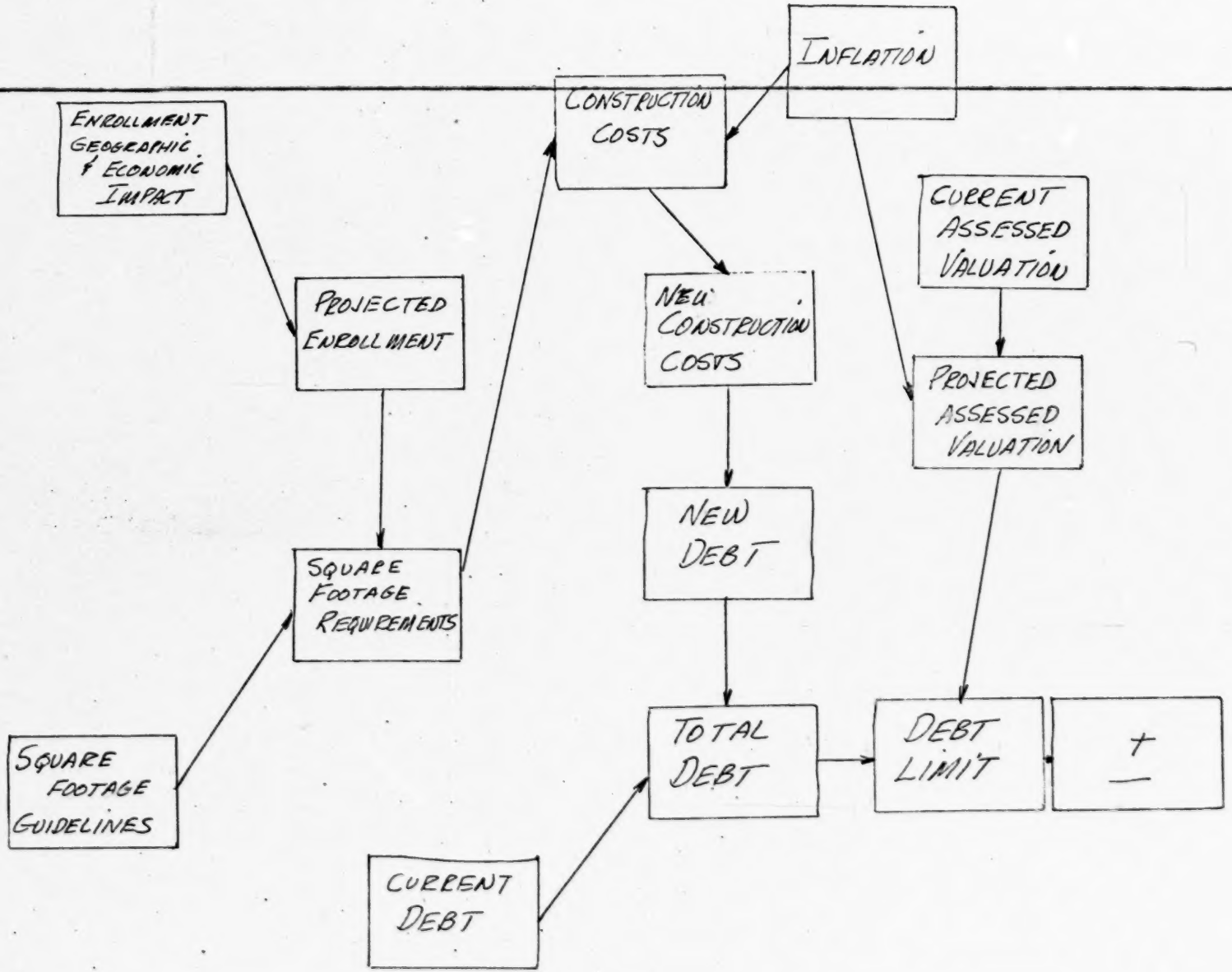
2586
1971
1972
1973
1977
1987


BY SCHOOL ENROLLMENT 7-12
PROJECTED ENROLLMENT BY SCHOOL 7-12
EDUCATIONAL SPECIFICATIONS
CURRENT BY DEPT. SQUARE FOOTAGE PER STUDENT
PROJECTED ENROLLMENT BY DEPT. BY SCHOOL BASED UPON CURRENT %'S
SPACE REQUIREMENTS
CURRENT DESIGN CAPABILITY
SPACE REQUIRED
% STUDENTS BY DEPT
% SPACE BY DEPT
CURRENT BY DEPT. 7-12 ENROLLMENT
CONST. COST PER SQUARE FOOT
CURRENT SQUARE FOOTAGE BY DEPARTMENT
TOTAL COST NEW SPACE
WATER
WATER LINES
REVENUES
INDUS
BEDROOMS
ROADS
CURRENT ENROLLMENT K-6
PROJECTED INCREASE
AREA DENSITIES
HIGH
MEDIUM
LOW
PROJECTED ENROLLMENT INCREASE BY SCHOOL
TOTAL PROJECTED ENROLLMENT
SQUARE FEET PER STUDENT GUIDELINES
SQUARE FEET PER SCHOOL REQUIRED
DESIGN CAPACITY
NEW SPACE REQUIRED
CONST. COST PER SQUARE FT.
NEW DEBT
EDUCATIONAL SPECIFICATIONS
TOTAL COST NEW SPACE
OLD DEBT
TOTAL DEBT
CURRENT ASSESSED VALUATION
PROJECTED ASSESSED VALUATION
DEBT LIMIT
+
—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CONSTRUCTION COSTS
ENROLLMENT GEOGRAPHIC & ECONOMIC IMPACT
CURRENT ASSESSED VALUATION
PROJECTED ENROLLMENT
NEW CONSTRUCTION COSTS
PROJECTED ASSESSED VALUATION
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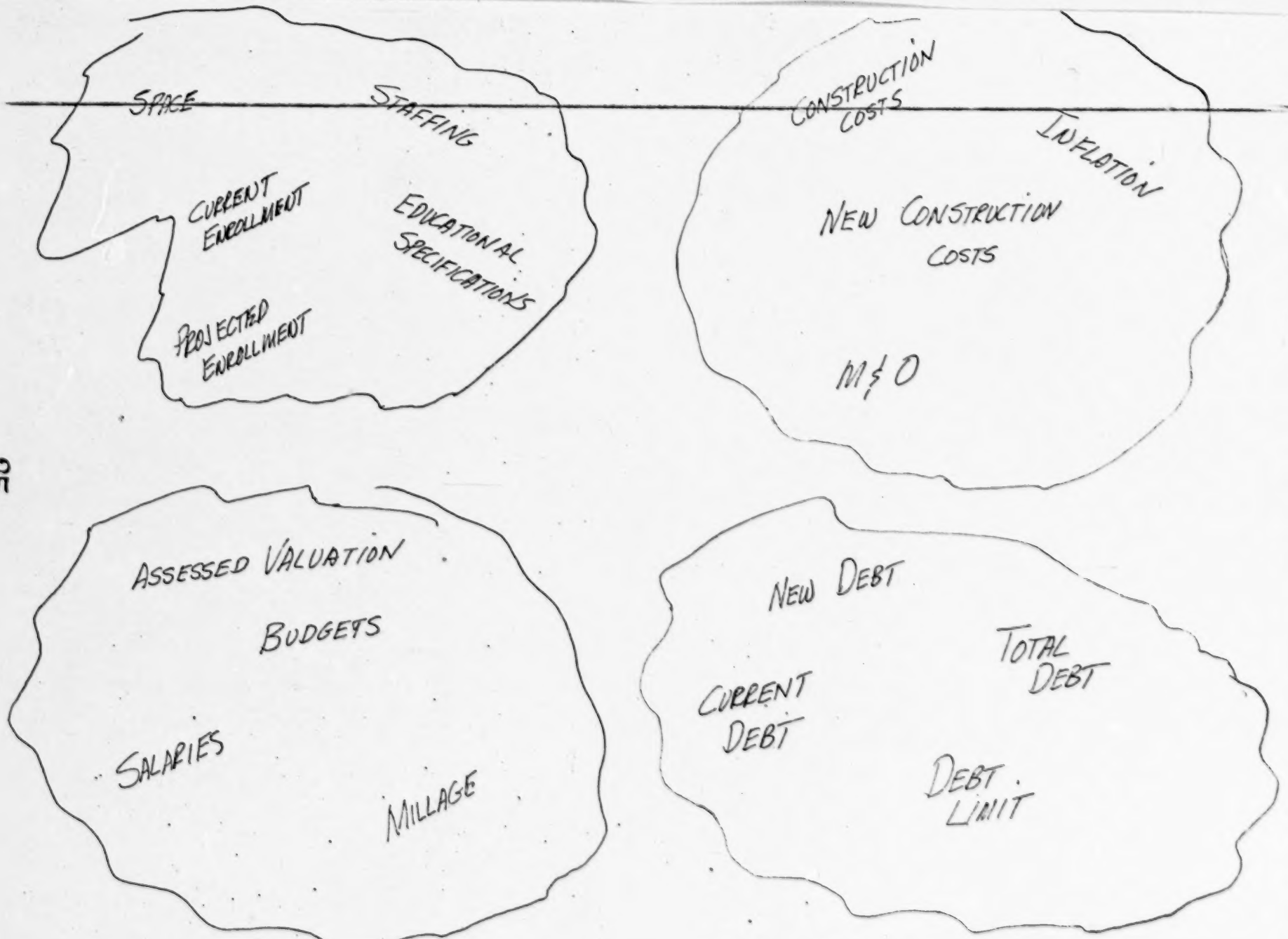
SQUARE FOOTAGE REQUIREMENTS
TOTAL DEBT
DEBT LIMIT
+
—
SQUARE FOOTAGE GUIDELINES
CURRENT DEBT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STAFFING
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INFLATION
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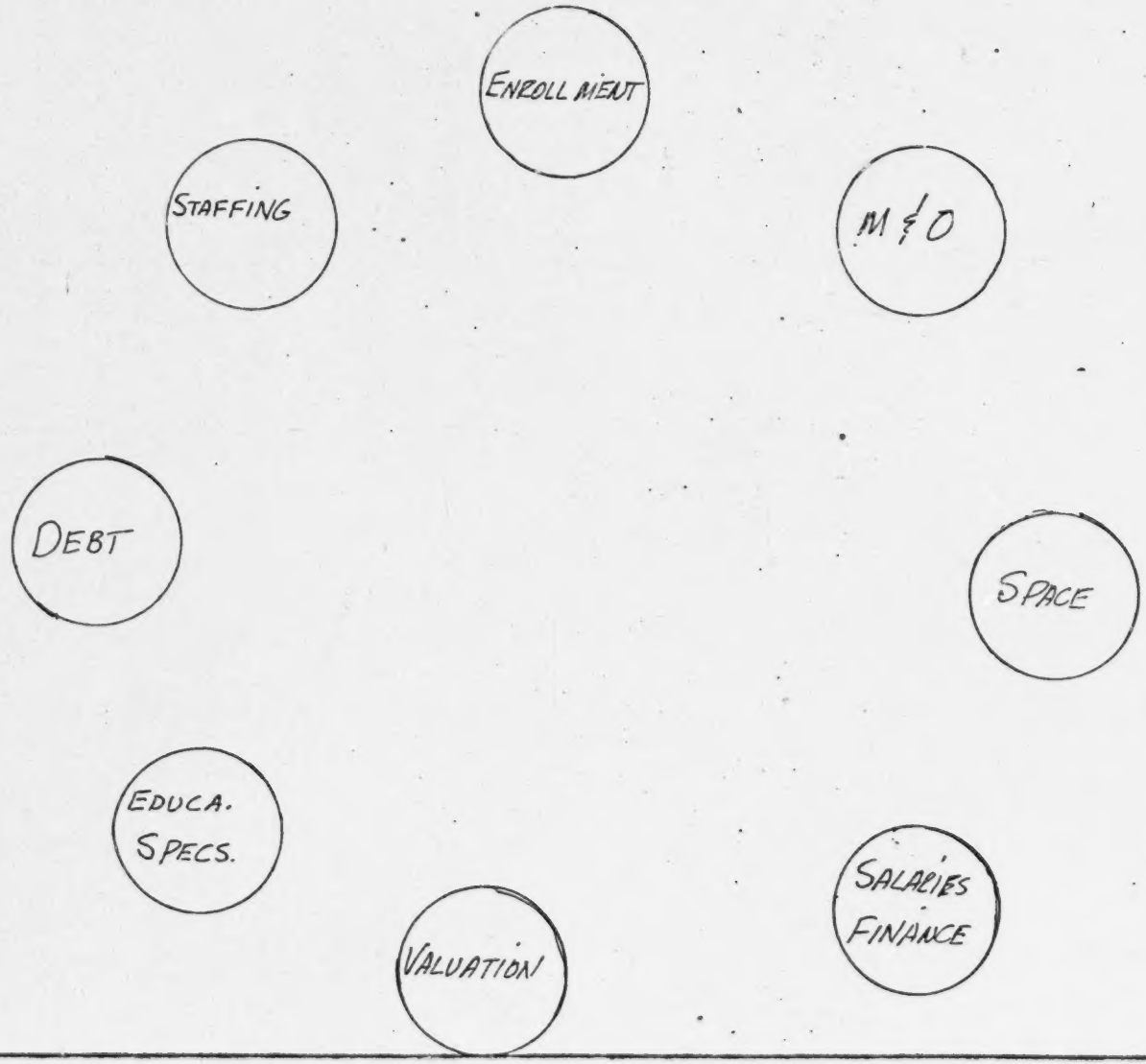
TOTAL DEBT
CURRENT DEBT
DEBT LIMIT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STAFFING
M & O
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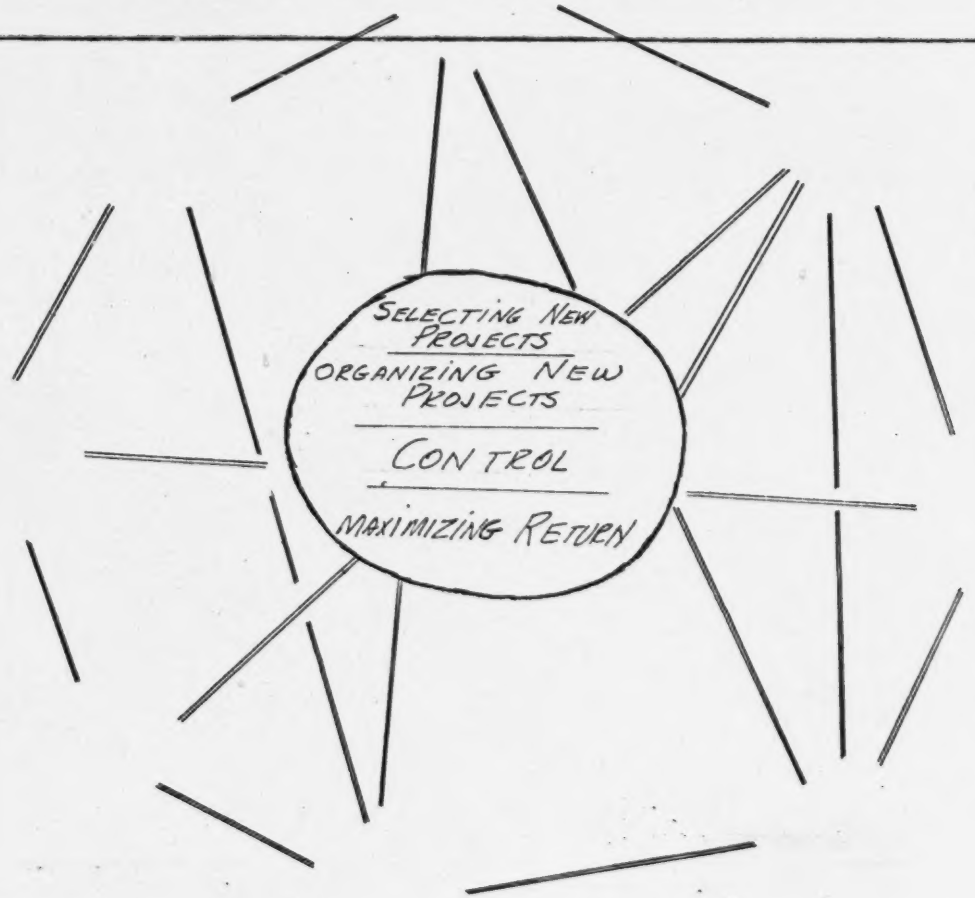
EDUCA. SPECS.
SALARIES FINANCE
VALUATION

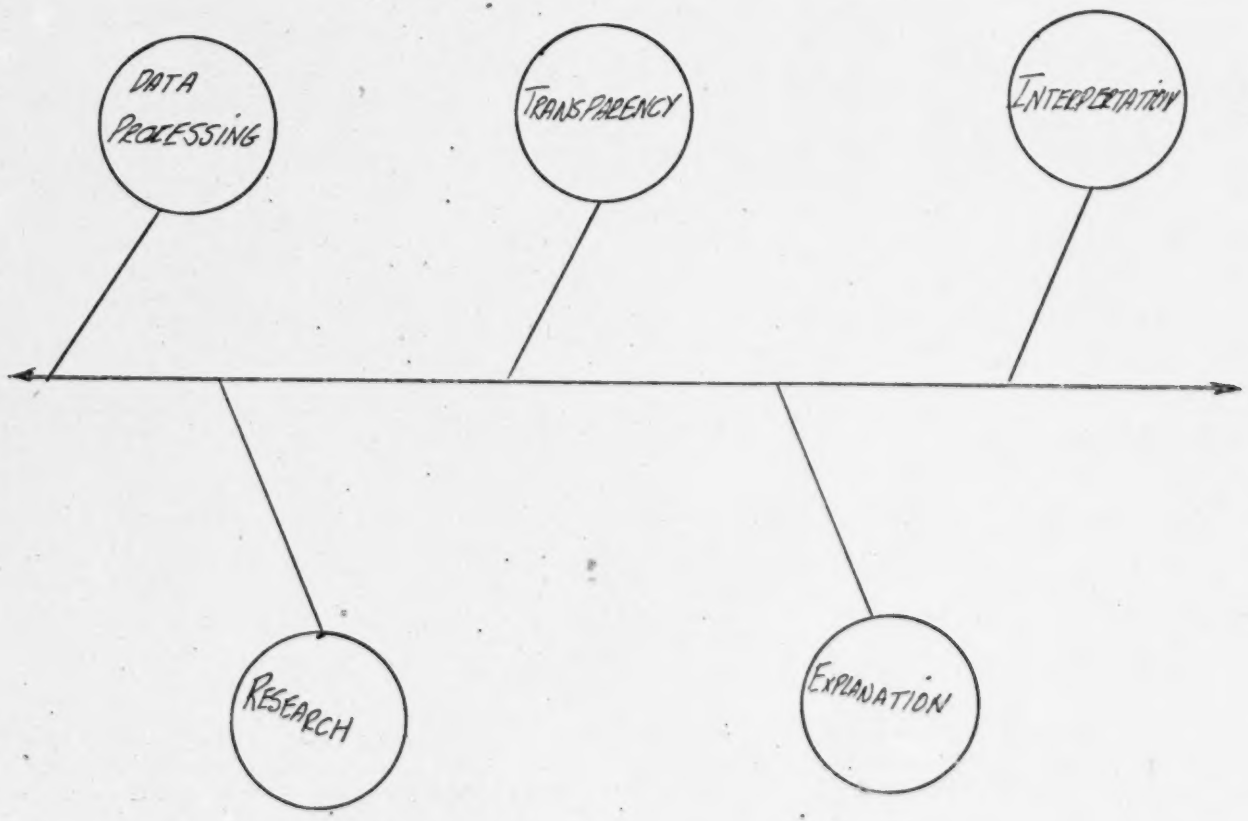
PERIPHERAL DATA PROCESSING CAPABILITY



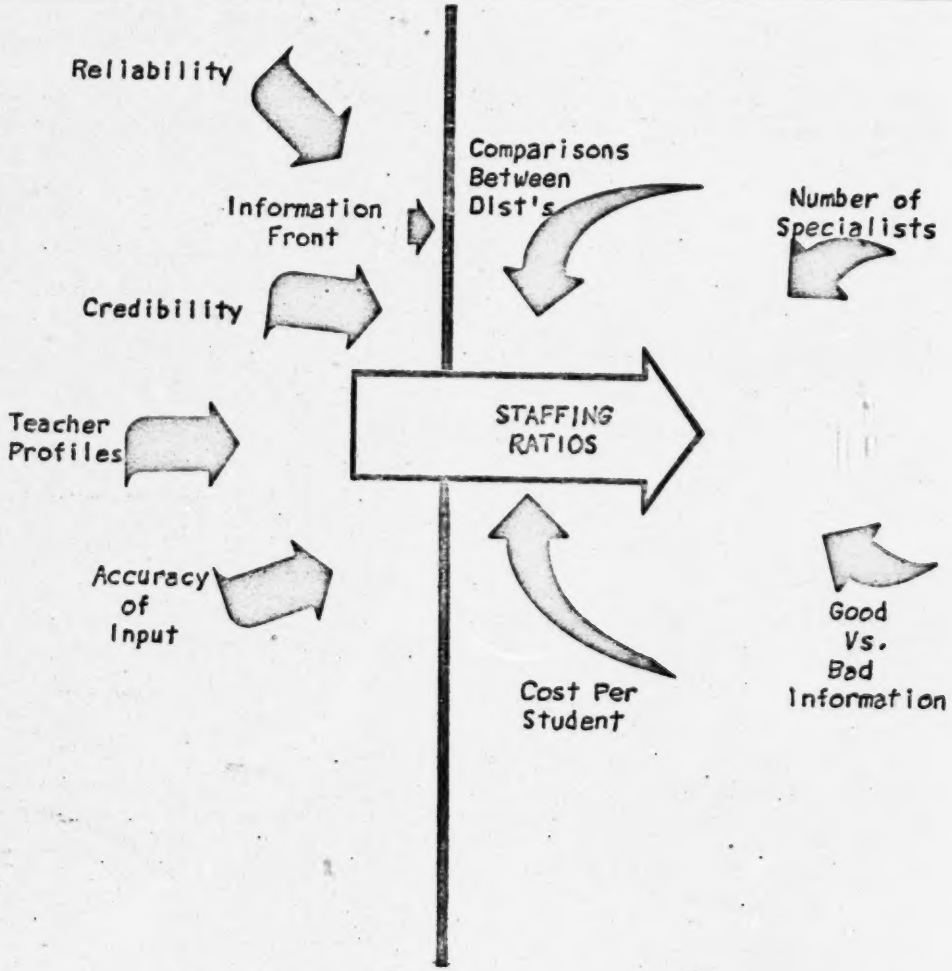
COORDINATION

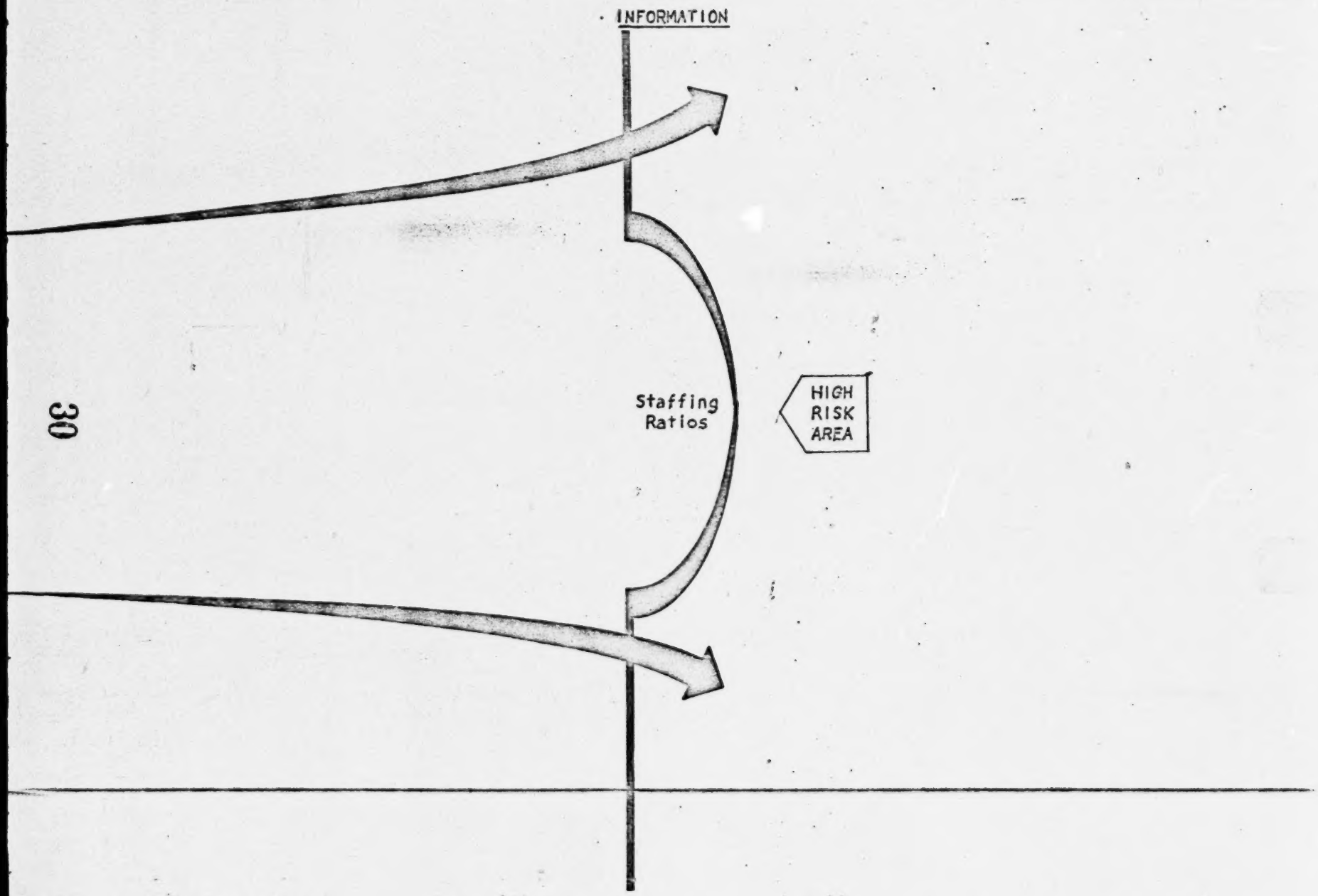
MANAGEMENT

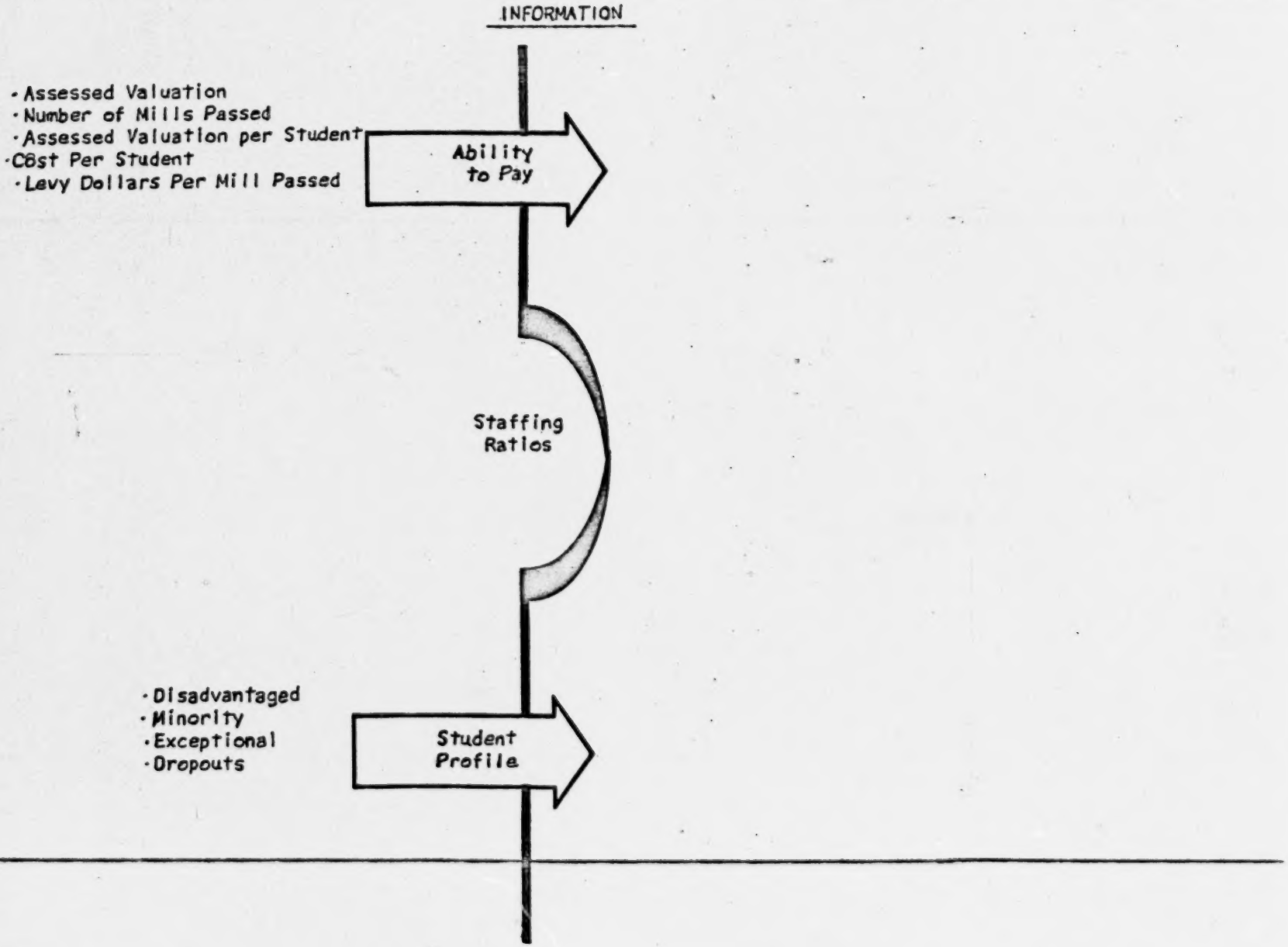
INFORMATION SERVICE

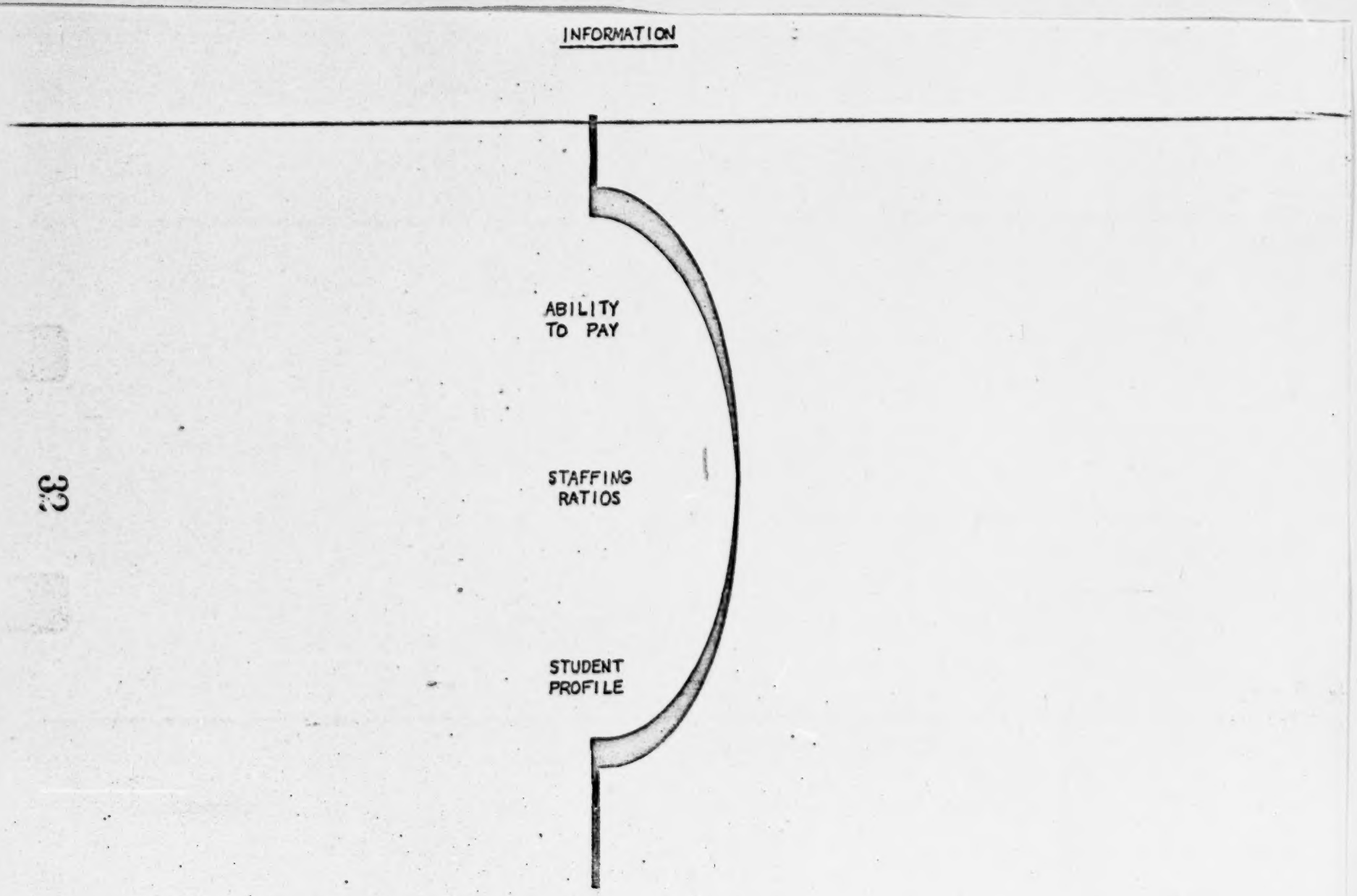


INFORMATION

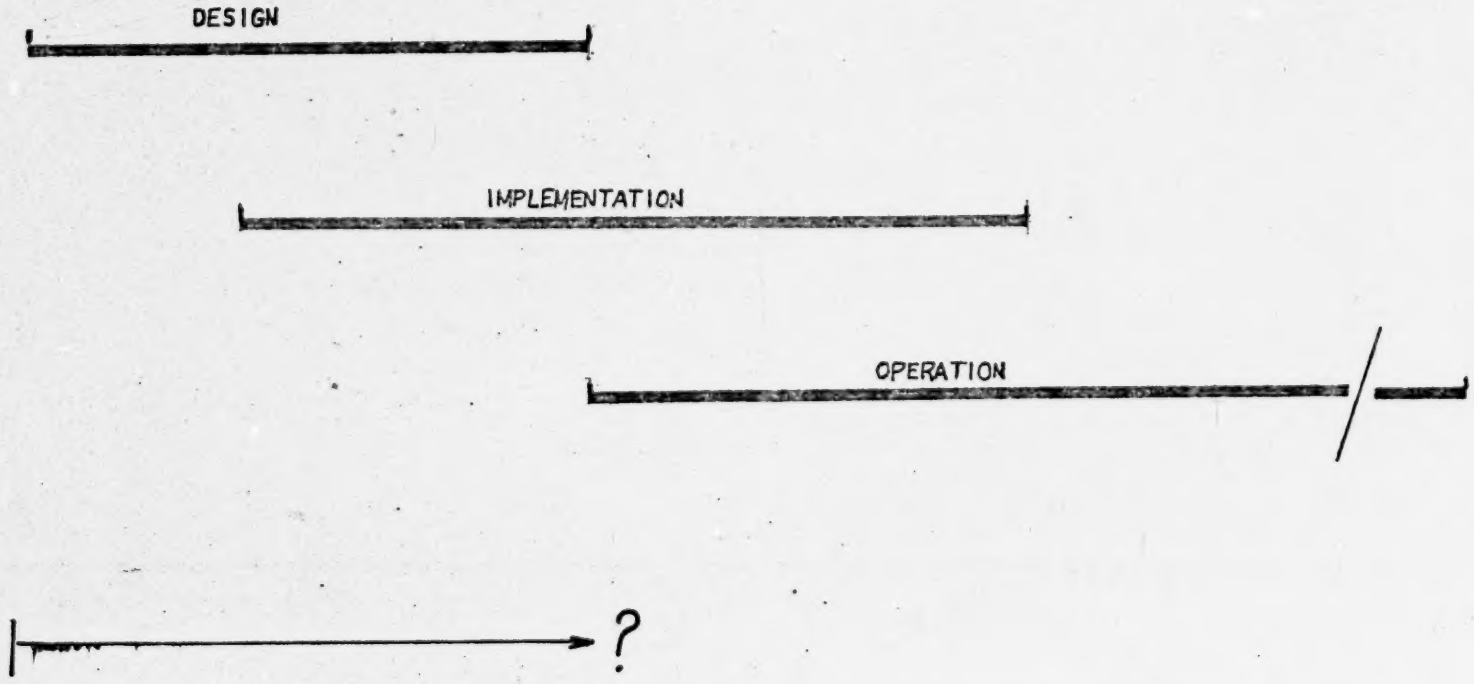



INFORMATION
Staffing Ratios
HIGH RISK AREA

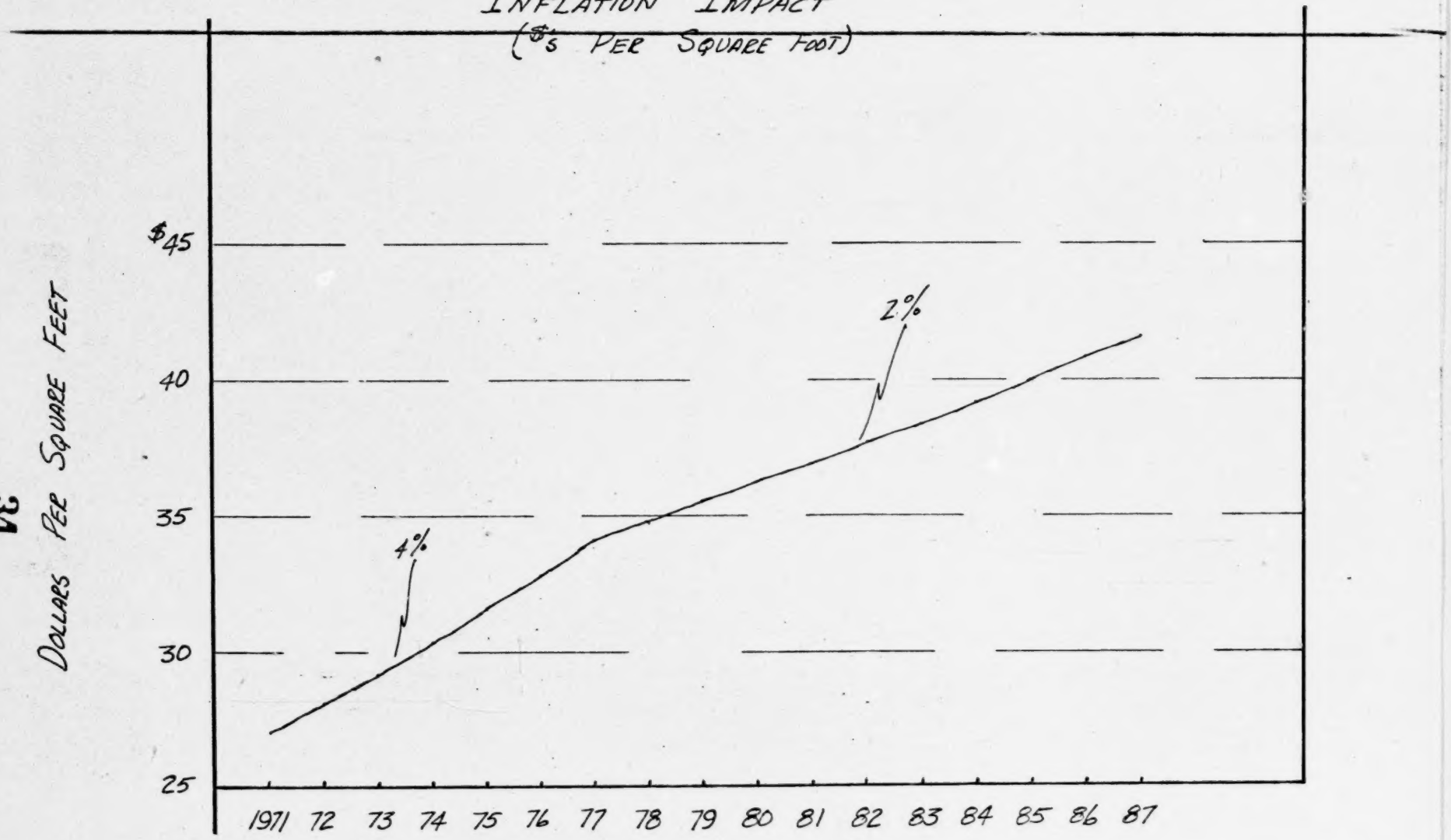

INFORMATION
• Assessed Valuation
• Number of Mills Passed
• Assessed Valuation per Student
• Cost Per Student
• Levy Dollars Per Mill Passed
Ability to Pay
Staffing Ratios
• Disadvantaged
• Minority
• Exceptional
• Dropouts
Student Profile


INFORMATION
ABILITY TO PAY
STAFFING RATIOS
STUDENT PROFILE

NEW OR MODIFIED INFORMATION
~~FLOW TIME REQUIREMENTS~~



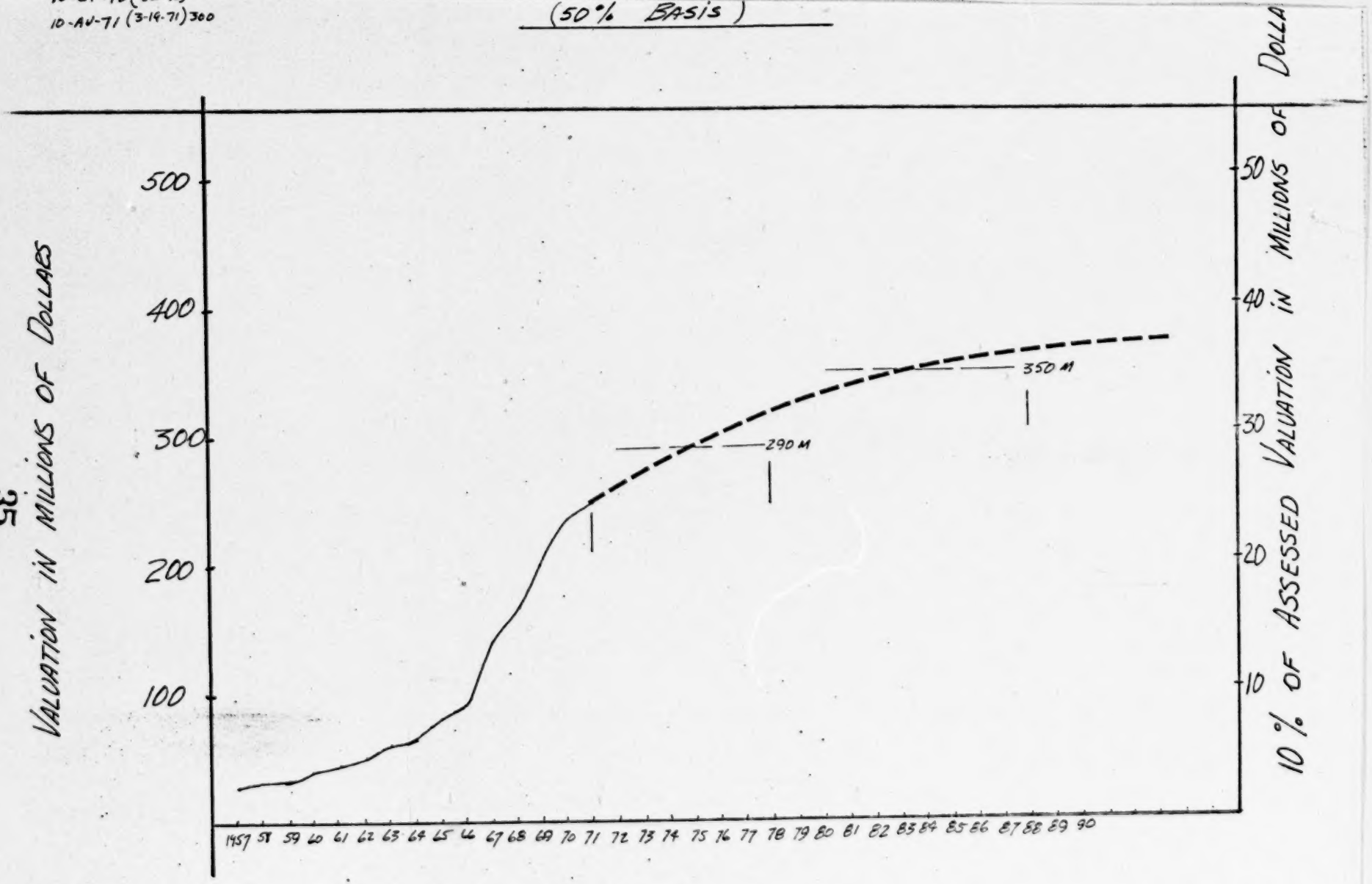
Estimated Construction Costs
Inflation Impact
($'s Per Square Foot)



Dollars/Sq. Ft.	27.00	28.08	29.20	30.37	31.58	32.84	34.15	34.83	35.53	36.24	36.96	37.70	38.45	39.22	40.00	40.80	41.62

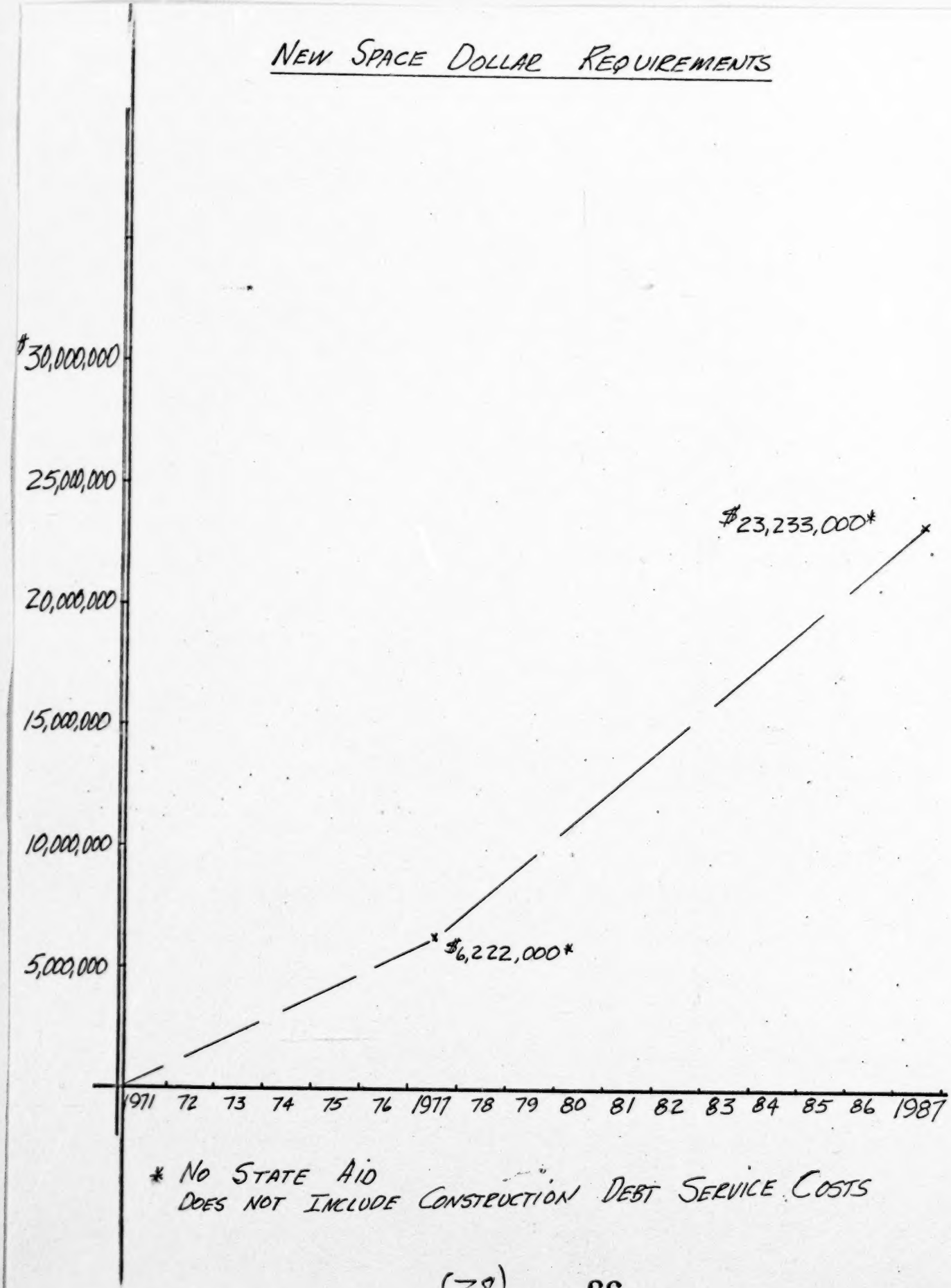
10-GF-72 (5-10-72)
10-AV-71 (3-19-71) 300

(50% BASIS)



35

NEW SPACE DOLLAR REQUIREMENTS



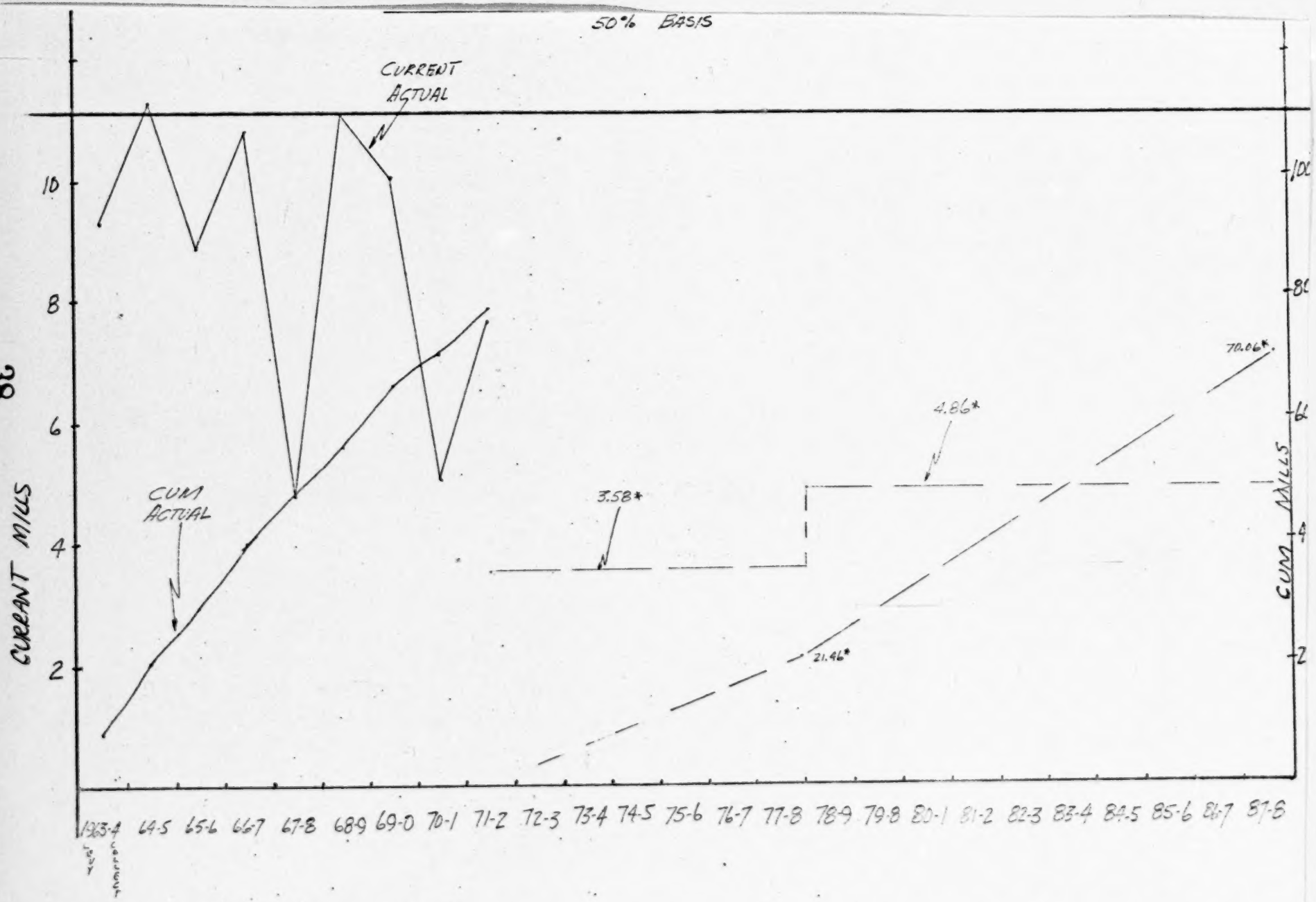
* NO STATE AID
DOES NOT INCLUDE CONSTRUCTION DEBT SERVICE COSTS

TOTAL SPACE AND DOLLAR REQUIREMENTS

BY 1977 and 1987

	Total Space Required (Sq. Ft.)	1971 Design Capacity (Sq. Ft.)	New Space Required (Sq. Ft.)	Estimated Construction Cost Per Sq. Ft.	Total Cost New Space
1977	1,524,674	1,319,809	204,865	$ 30.37	$ 6,221,750
1987	1,936,080	1,319,809	616,271	37.70	23,233,417

37



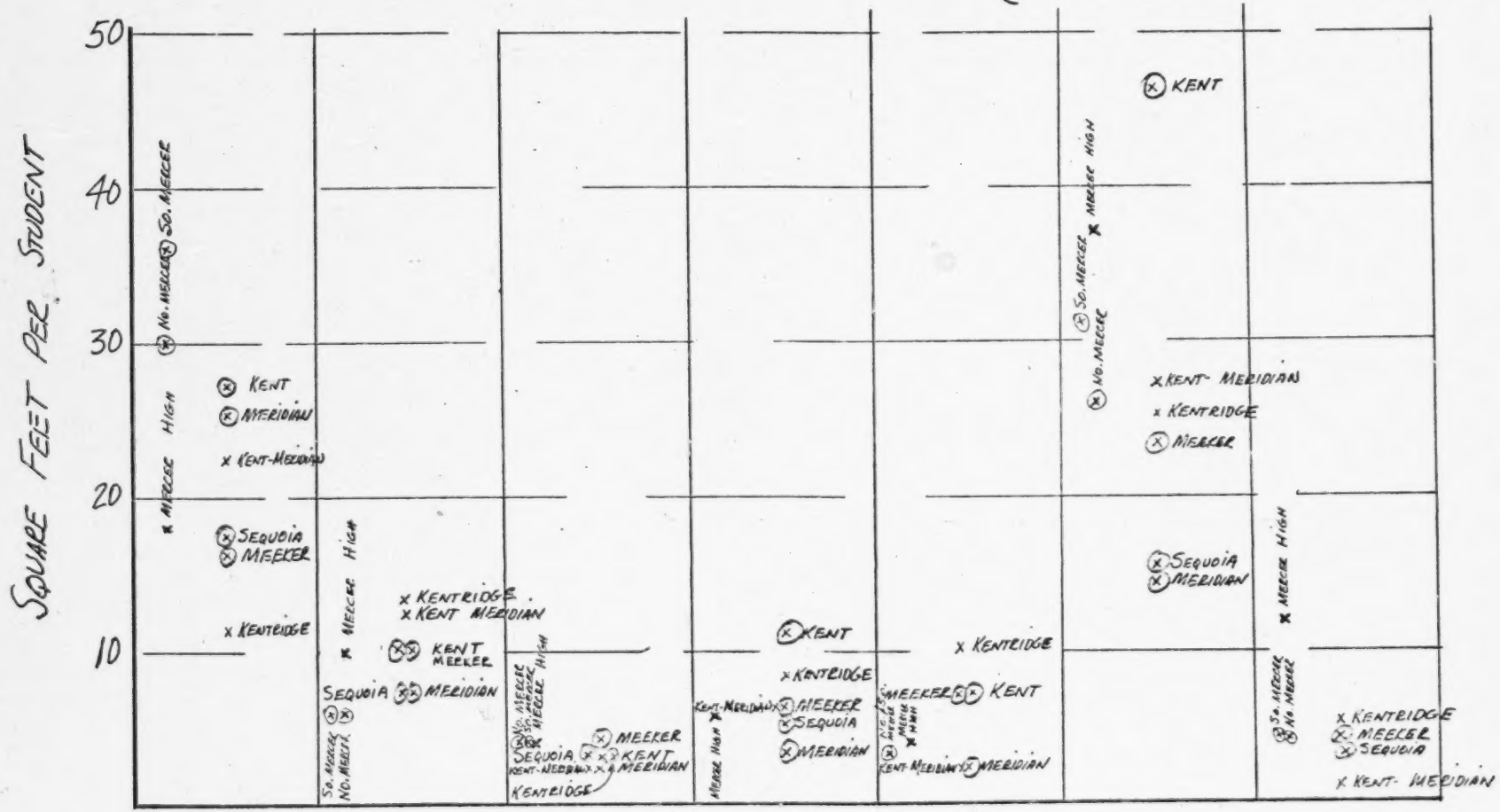
* DOES NOT INCLUDE CONSTRUCTION DEBT SERVICE COSTS

APPENDIX B

SPACE PER STUDENT* BY DEPARTMENT

⊗ JR. HIGH
× SR. HIGH

KENT { 10-1-71 ENROLLMENT
SQ. FOOTAGE BASED UPON STATE ALLOWED DESIGN CAPACITY

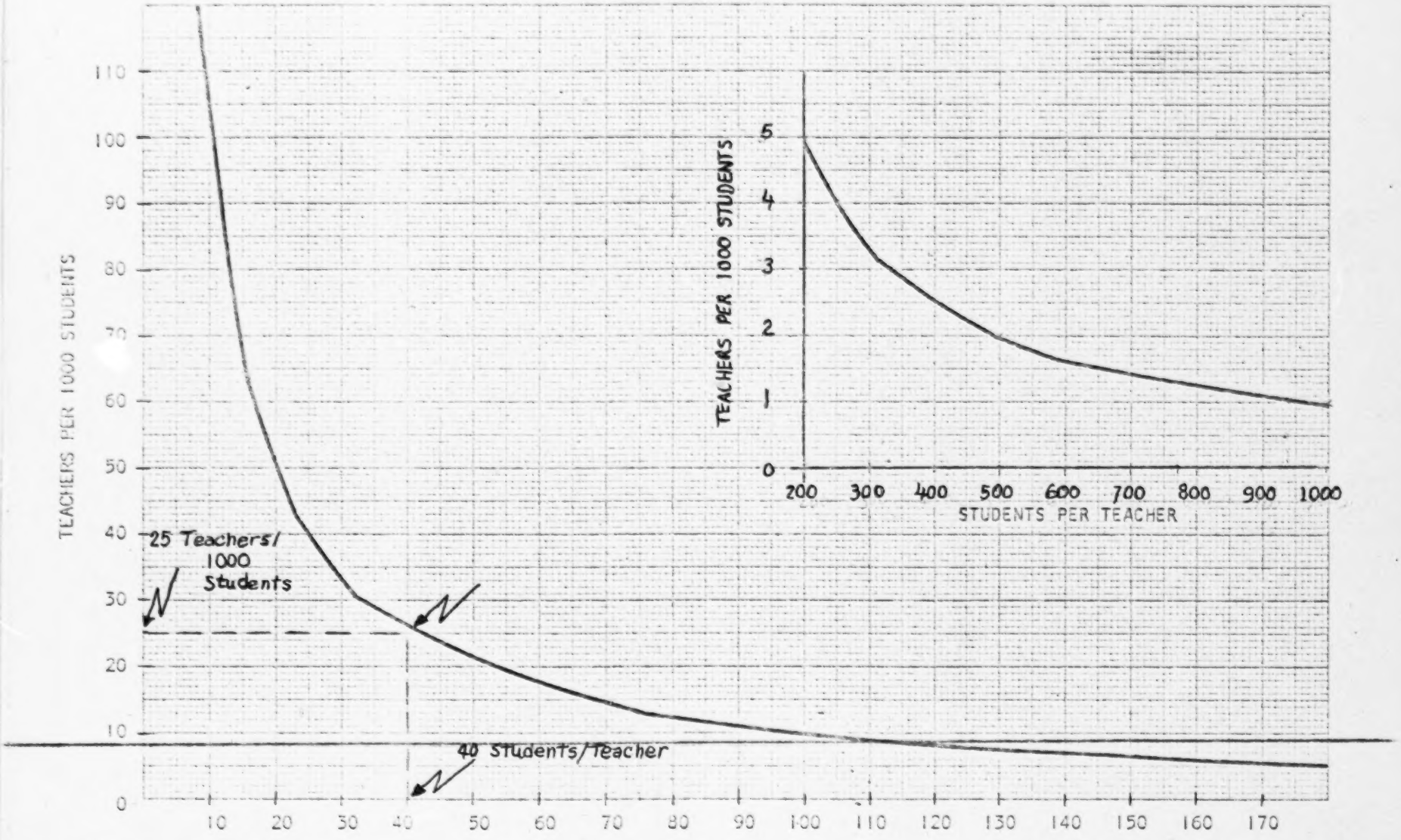


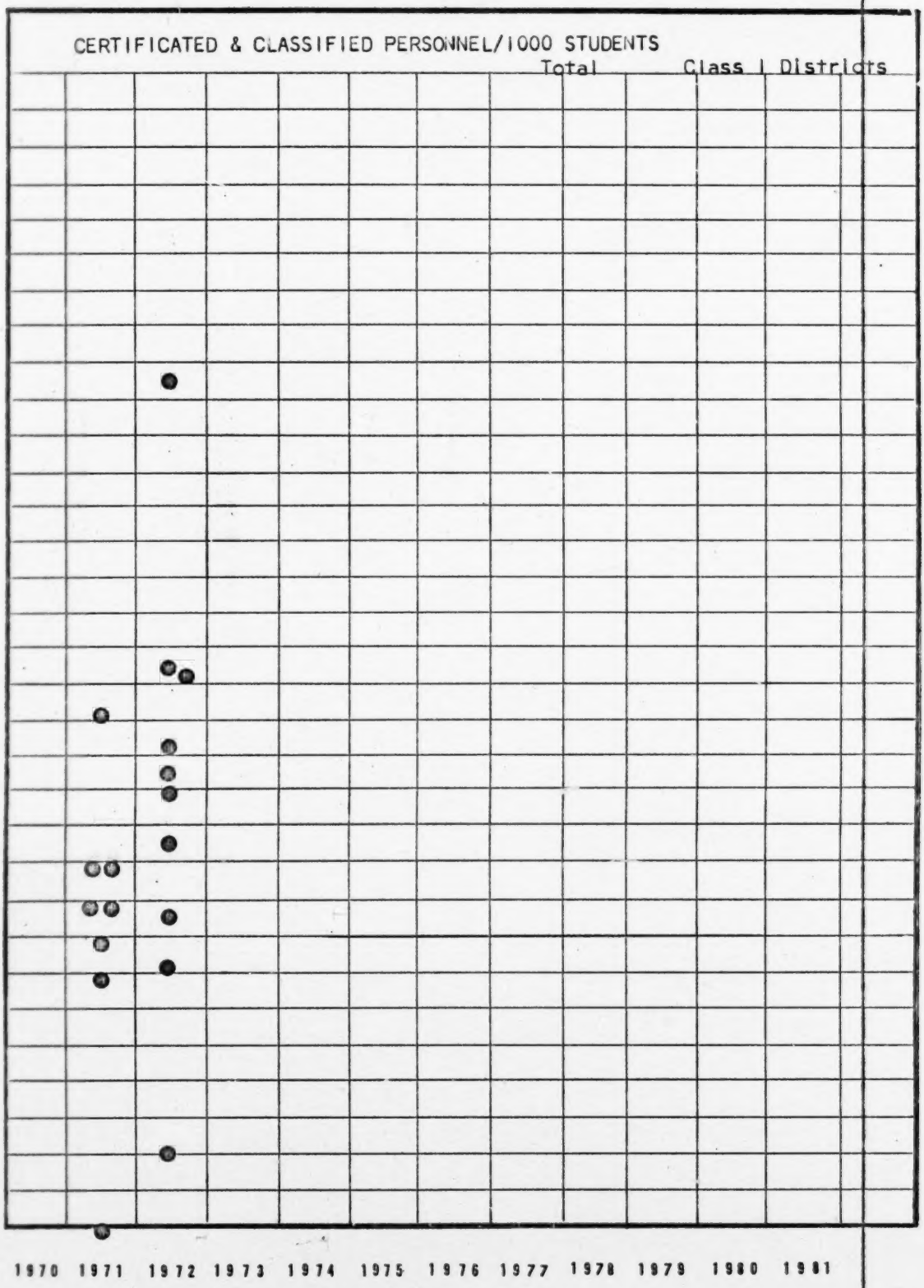
(32)

APPENDIX C

CONVERSION CHART

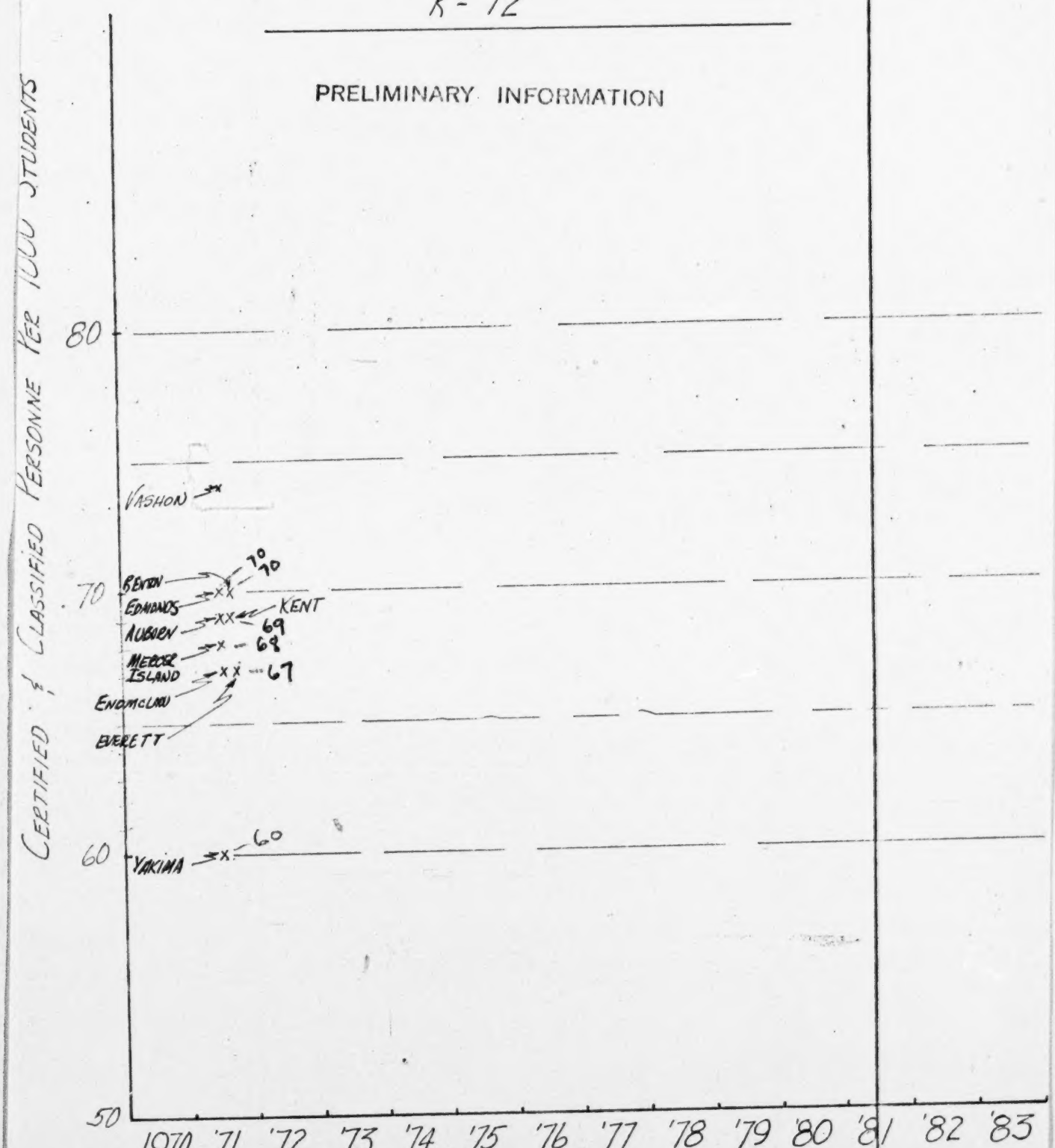
TEACHERS/1000 STUDENTS ⇄ STUDENTS/TEACHER



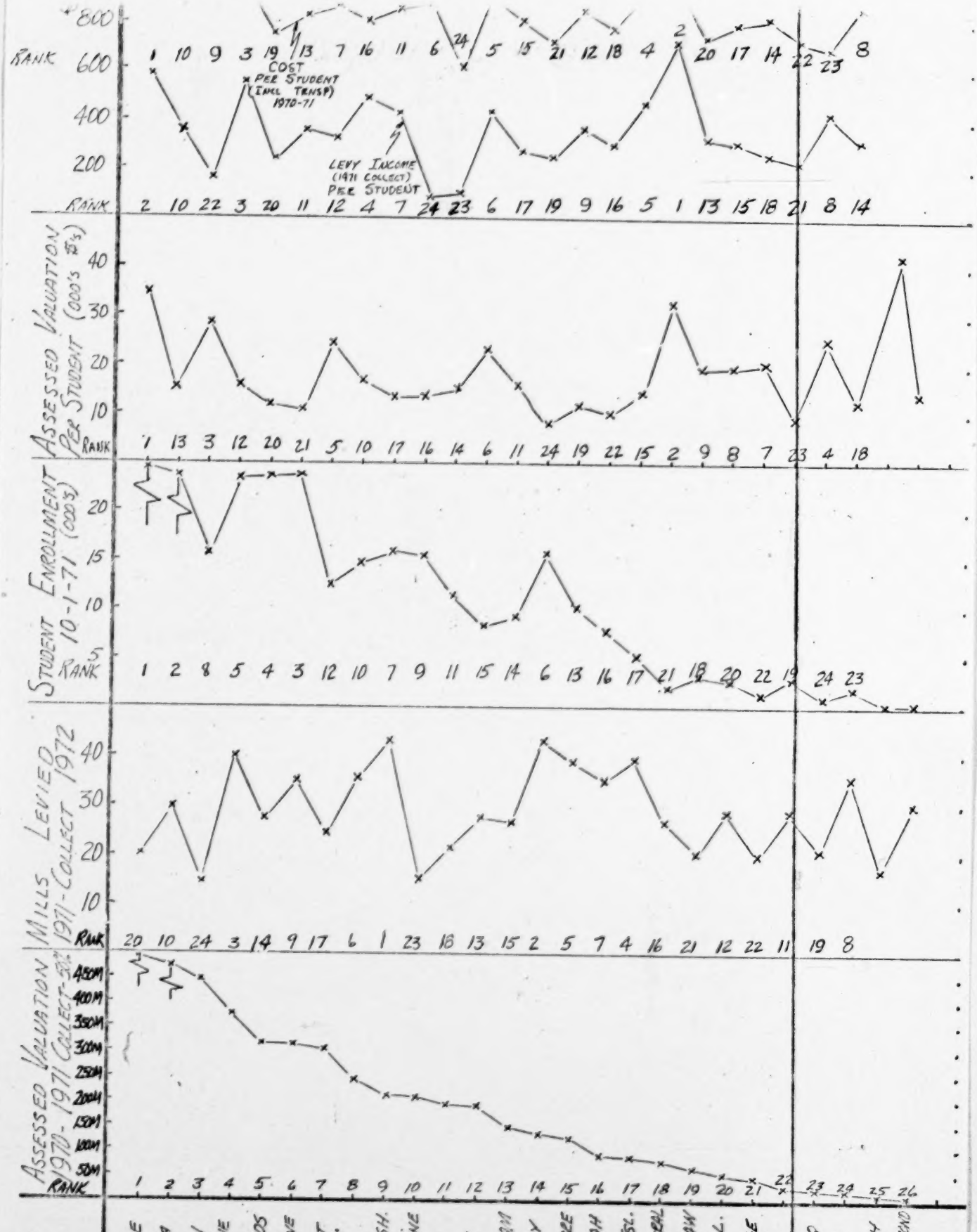

CERTIFICATED & CLASSIFIED PERSONNEL/1000 STUDENTS
Total
Class I Districts
90
85
80
75
70
65
60
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981

CERTIFIED & CLASSIFIED PERSONNEL PER 1000 STUDENTS K-12

PRELIMINARY INFORMATION



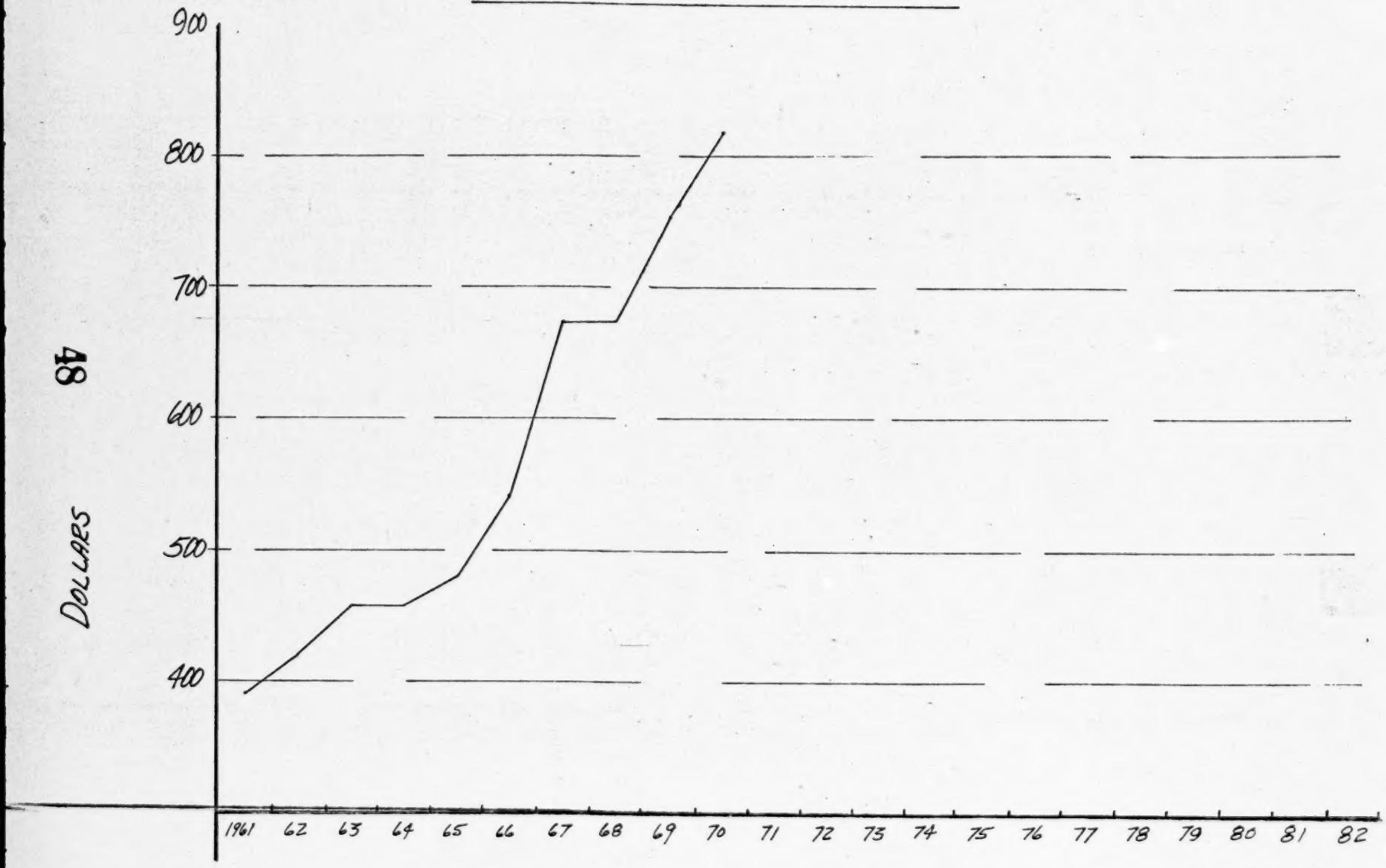
APPENDIX D


COST PER STUDENT (INCL TRNSP) 1970-71
LEVY INCOME (1971 COLLECT) PER STUDENT
ASSESSED VALUATION PER STUDENT (000's $'s)
STUDENT ENROLLMENT 10-1-71 (000's)
MILLS LEVIED 1971-COLLECT 1972
ASSESSED VALUATION 1970-1971 COLLECT-50%
RANK
SEATTLE
TACOMA
RENTON
BELLEVUE
EDMONDS
HIGHLINE
EVERETT
MENT
LK. WASH.
SHORELINE
YAKIMA
AUBURN
BELLINGHAM
FED. WAY
NORTHSHORE
SSAQUAH
NDER ISL.
SO. CENTRAL
ENWICLAW
WOOD VAL.
PANBIDGE
AHOMA
MT. SNOQ
ASHON
YXCOMISH
DIAMOND

APPENDIX E

SOURCE: ESD 4C71
3-CP-72

PER PUPIL COST (INCL TRANSP)
BAINBRIDGE ISLAND



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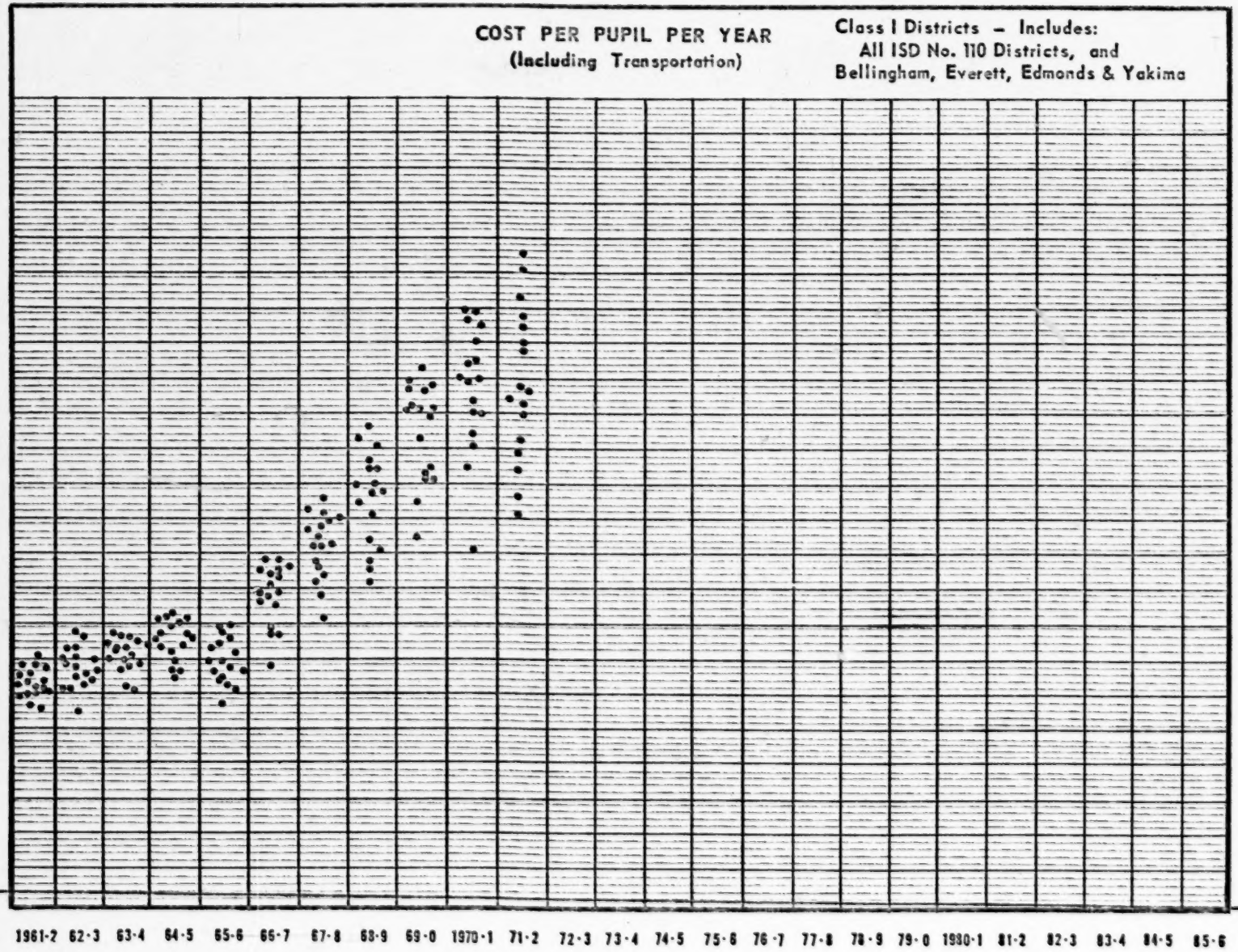
	1961	62	63	64	65	66	67	68	69	70
DOLLARS	389	419	456	456	478	540	671	672	753	817



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